

GUIDE

How to solve noise issues in your HVAC appliance

4 steps to get started on optimising the noise levels in your HVAC appliance.



Welcome to your guide on how to solve noise issues in your HVAC appliance.

The market regulations for noise levels in HVAC appliances are constantly changing and tightening. At the same time, the end-users' expectations to high quality feeling in the products are increasing.

Your customer's perception of your product is important, and the noise levels play a crucial role in this perception. If your customer experiences an irritating sound from your product, they will most likely associate it with poor quality. If it on the other hand is silent, they will associate it with high quality as you intended.

If you work in a company that provides HVAC appliances and want to stay competitive, you need to adapt to these changes. It can be difficult to figure out what adjustments need to be made in your product, so we have made a guide on how you can get started. The guide is useful for you whether you want to optimise the noise levels of your existing HVAC appliance or incorporate low noise levels into a new product you are working on.

So, how do you create a second to none user experience for your customers – while keeping the development and production processes effective and efficient? Do you want inspiration and competent feedback on how to get started?

Then continue reading this guide.

Enjoy!

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IDENTIFY THE SOURCE OF THE NOISE

When you want to develop a new HVAC product or improve the noise levels of an existing product, you need to understand the terms of noise reduction – while asking yourself exactly what you want to improve.

To get an understanding of the noise terms, you need R&D capabilities on noise and vibration, such as noise & vibration specialists and sound testing facilities. This enables you to root-cause analyse your product and locate the noise source.

SO, WHAT IS NOISE?

The professional expression for unwanted sound is airborne noise and for unwanted vibration it is structure borne noise.

Examples:



Airborne noise could be the sound of an airplane taking off. The noise here is traveling through the air and we are able to hear it from a long distance.



Structure borne noise could be an old house placed close to a railway. When the train is passing by, vibrations are traveling from the track through the ground to the construction of the house, and the house then starts to vibrate for a while.

When you understand noise, you need to perform a root-cause analysis of your product. This can be broken down into these steps

1

Identify the noise type

Listen to your product. Is the noise mainly airborne, structure-borne or a combination of both?

2

Define operating conditions

Understand how the product operates. Identify normal, worst-case and maximum operating conditions.

3

Map the key components

Identify the main components and where noise and vibration may originate or be transferred.

These are the preliminary steps of your root-cause analysis. You will need test facilities to locate the source and achieve the best possible noise reducing results. Depending on your product application and requirements for the solution, you should consider doing these tests:

- Structure analysis
- Sound and vibration test of product in operations
- Sound intensity measurement
- Sound absorption and transmission loss test

BPI's dedicated Innovation Centre houses our sound-testing facilities, including a semi-anechoic chamber. The walls and ceiling use PureSound® to absorb sound, creating a reflection-free acoustic environment, while the floor remains reflective.

The chamber is isolated from the surrounding building through high-performance sound insulation in the walls and doors, while the floor is decoupled using VibraFlex® vibration isolation. This ensures low background noise and prevents external vibrations from affecting the test results.

Do you want to see what a sound lab could look like?
Take a look into our sound lab and toolbox [here](#).

DOES YOUR HVAC PRODUCT HAVE A NOISE CHALLENGE?

We are currently looking for companies with a noise issue in their HVAC appliance to take part in a project. The project includes a root-cause analysis of your product, prototype and documented improvements of your product. And you agree that we can use the findings in our marketing material.

Do you want to participate?

[Yes, I want to apply](#)



CHOOSE AN IDEAL NOISE REDUCING MATERIAL

When you have located the source of your noise, the next step is to consider what noise reducing material is ideal to secure optimum noise reduction. If you want an effective development process when you choose your material, you need to consider:

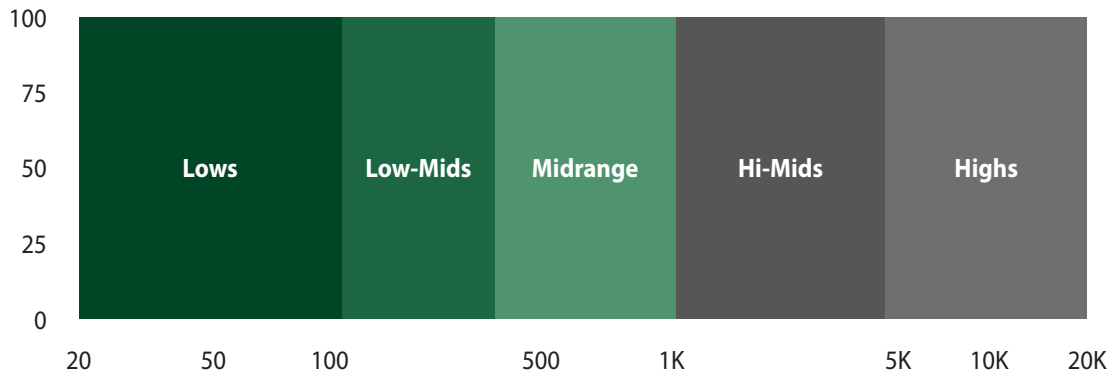
- What are your own demands for the solution?
- How much noise does your product make?
- What is the size of the component making the noise?
- What are your preference for the level of sustainability in the material?
- What are your demands for the visual appearance of the solution? Will it be visible for the consumer, or will the noise reduction be hidden? (How aesthetic does it need to be?)
- What are the detail levels on the component making the noise?
- What are your tolerances?
- How many units of noise reducers do you need?
- What is your budget?

At BPI, we are specialists in solving customer-specific noise issues in electronic appliances. We have developed materials with the sole purpose of reducing noise and vibrations in both high and low frequency ranges. Due to the proven noise and vibration reducing qualities of our polyurethane products, we recommend these materials for a customised solution.

We want to give you an overview of which products are suitable for different frequencies, ranging from 20 Hz to 20.000 Hz. This is the generally accepted range of human hearing, and within this range, it can be useful to divide up the overall audible frequency range into several frequency ranges. You can use this as a broad reference when you address specific noise phenomena and use different product applications.

Frequency ranges and material overview

The human ear picks up roughly 20 Hz to 20,000 Hz. Splitting that range into lows, mid-lows, midrange, hi-mids and highs makes it easier to match a specific noise phenomenon to the right product.



Depending on the frequency of your noise issue, we have a range of products that are individually ideal for reducing airborne and structure borne noise:

Product	Frequency range	Type of noise	Conversion options
PureSound® E	Low-mids to highs	Airborne	Cut solution
Setex® Post-Industrial	Low-mids to highs	Airborne	Cut solution
PureXilence 3D®	Low-mids to highs	Airborne	Moulded solution
PureXilence 3D® tuned to fit	Lows to midrange	Structure borne	Moulded solution
VibraFlex®	Lows	Structure borne	Cut or moulded solution
VibraSetex®	Lows	Structure borne	Cut solution

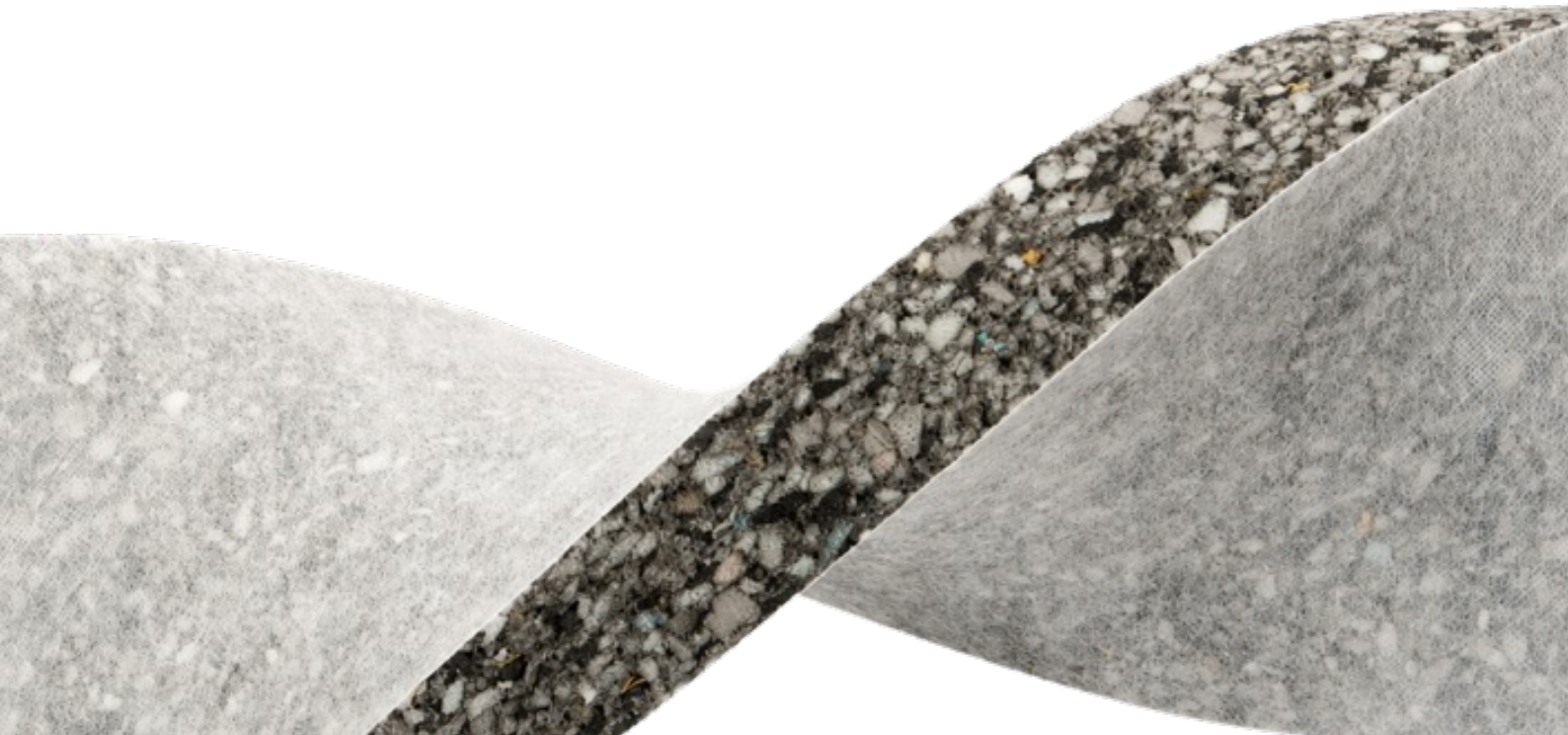
Choosing recycled material solutions – Setex®

Choosing recycled materials doesn't have to mean compromising effective noise reduction. Setex® is a mechanically recycled, bonded polyurethane foam. It has been proven to have great properties such as sound absorption and vibration damping in heating, ventilation and refrigeration areas. Depending on the variant, Setex® contains up to 92 % recycled content sourced from foam production waste or discarded mattresses.

Why choose Setex®

- More homogeneous quality and consistent performance
- High impact and vibration absorption
- Improved acoustic comfort
- Flexible densities and thicknesses
- On average, 80 % lower CO₂-eq emissions compared to fossil-based PU foam

Our Product Carbon Footprint (PCF) calculation follows ISO 14040/44/67 and uses cradle-to-gate methodology. CO₂-eq reduction based on internal PCF calculations comparing Setex® products with conventional fossil-based PU foam alternatives. Results may vary depending on product specification and application.



Depending on your root-cause analysis, we would recommend one of two solutions: a cut 2D solution or a 3D moulded solution - both designed 100% to fit your product and reduce the frequencies.

CUT SOLUTION

Customer case – Compressor noise reduction

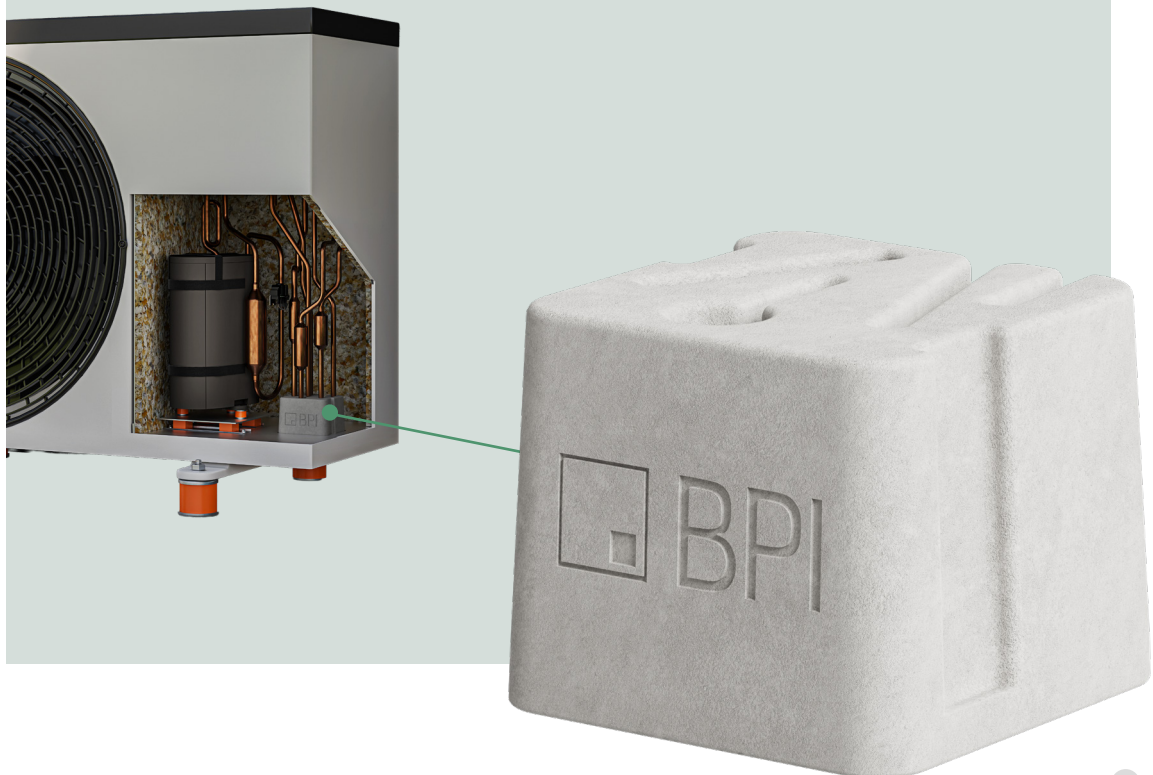
- **The challenge** A heat pump manufacturer wanted to reduce noise generated by the compressor without compromising the design or functionality of the unit.
- **The solution** BPI developed a tailored acoustic compressor jacket designed around the specific compressor and available space. The solution targets noise directly at the source and can be tested and optimised in BPI's acoustic laboratory, Sound Lab.
- **The materials** The solution combines BPI Setex® Post-Consumer as an acoustic absorption layer with BPI Heavy Layer Flex as a flexible high-mass barrier, addressing both sound absorption and sound transmission.
- **The value** An application-specific solution designed to reduce compressor noise and improve the overall acoustic comfort of the heat pump.



MOULDED SOLUTION

Customer case: Pipe vibration isolation in a heat pump

- **The challenge** A heat pump manufacturer wanted to reduce noise and vibration generated by refrigerant pipes within the limited space of the unit.
- **The solution** BPI developed a tailored moulded solution designed around the specific pipe geometry. Using PureXilence 3D®, the solution combines effective noise reduction with a more sustainable material choice and can be tested and optimised in BPI's acoustic laboratory.
- **The material** PureXilence 3D® combines high sound absorption with a reduced CO₂ footprint.
- **The value** An application-specific solution that helps reduce pipe-related noise and vibration, with performance documented through sound intensity measurements and transmission loss testing.



BUILD, TEST AND DOCUMENT PROTOTYPES

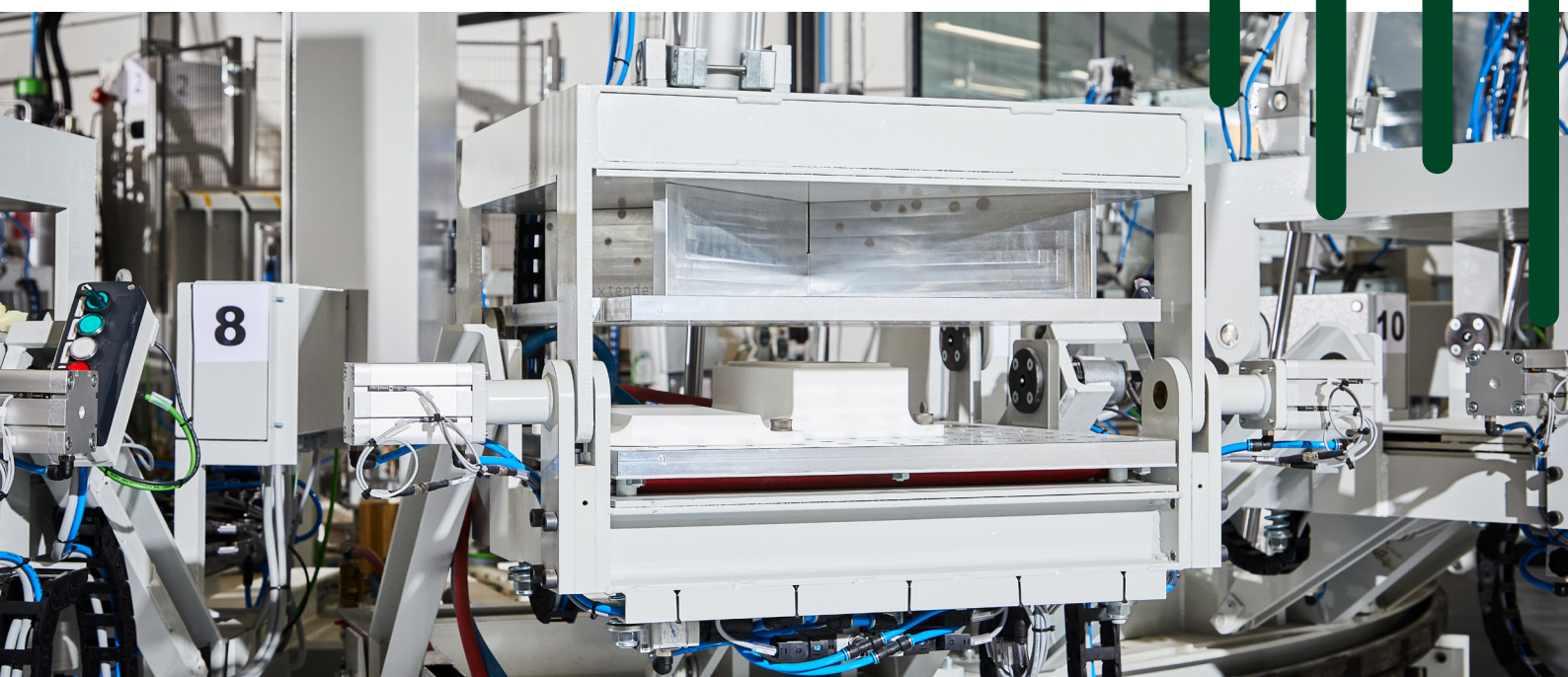
After this, you need to put together a team of specialists within construction, material development, and noise & vibrations. The team will go through the learnings from the root-cause analysis, prototypes, and find the suitable solution that fits the product and your requirements. To ensure the best noise reduction effect, we recommend setting up a test matrix.

The matrix should consist of different prototypes, where each prototype has a change, that either impact material property or geometric design. In this way we see which parameter to tune, to find the best optimize solution. Next, you should select a test method that easily shows the sound picture that you analysed earlier on.

Then you need to measure baseline and go through the matrix. Parallel to collecting data on each countermeasure, measurements are analysis and documented in sharp report, showing results and the gain effect in the specific area.

To be able to make the right prototype, you need these R&D capabilities:

- Test equipment to measure and gain knowledge about mechanical, acoustic, and viscoelastic properties of your chosen material
- Construction facilities and 3D printing lab for tailormade solutions
- Manufacturing setups such as material conversion and carousel moulding



Want to cooperate with a partner to solve your noise issue? BPI offers a concept, which includes a 100% customized noise reducing solution consisting of five steps:



1. ROOT-CAUSE ANALYSIS

To produce the best performing solution, we must first pinpoint the root of the noise problem of your product. To locate noise issues, our R&D specialists will do a thorough analysis in our in-house laboratory.



2. TAILORMADE 3D-DESIGN

Our specialists will then produce a tailor-made 3D mould in which to cast a noise reducing component with a perfect fit. With this method, we can address the issues we uncover in the initial root cause analysis with great precision.



3. DELIVERY OF SOLUTION

We deliver a complete solution tailor-made to your electromechanical product, efficiently reducing noise.



4. DOCUMENTED IMPROVEMENT

We provide full test documentation regarding the performance of your solution. If relevant, we also offer a live demo of the solution.



5. FAST TIME TO MARKET

Our capabilities in 3D printed moulds, an industrial production setup and flexible production capacity enable us to offer you a uniquely fast time to market.



We have a long track record of successful noise reducing solutions, where we have achieved a general noise reduction of 5-12 dB(A). In the diagram below, we illustrate how a noise issue can look with and without a noise reducing solution from BPI:

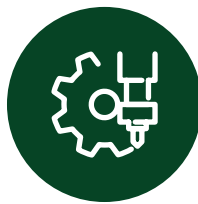
Global Sound Power	Baseline	w. BPI solution
Lw [dB]:	83	79

DECIDE HOW YOU WANT TO PRODUCE YOUR SOLUTION

When you have identified the source of the noise, you might have tried to manually decouple the noise by wrapping noise reducing material around the source. But it is time consuming and not a sustainable solution, if you want to grow your business. Depending on your requirements, you need to consider whether to choose a manual or automated way to produce your solution.

At BPI, we offer four different manufacturing concepts, where two of them apply to this exact solution: material conversion and carousel moulding.

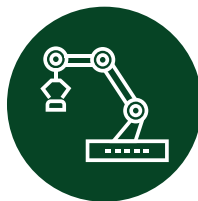
MATERIAL CONVERSION



Our technical processing centre is our most versatile manufacturing concept. We have the expertise to develop and manufacture products: from liquid chemistry to finished solutions.

This is supported by our production facilities in both Denmark and Poland, providing you with supply security and the opportunity to adapt your capacity.

CAROUSEL MOULDING:



Our fully automated carousel moulding concept is ideal for producing high-volume technical applications. The manufacturing concept is tact time-based and produces finished items that we cast in 3D printed moulds. This is a unique, patented moulding concept designed to handle rapid product launches and complex 3D geometries in technically functional items.

The manufacturing concept is versatile, and our R&D department can customise chemical compounds and develop solutions that meet your requirements. The concept is also based on industrial and scalable processes and can support high volumes, progressive growth, and seasonal variations.

LET'S DISCUSS YOUR NOISE AND VIBRATION CHALLENGE

Are you looking for a customised noise-reduction solution for your HVAC application?

Henning is ready to discuss your requirements and connect you with the right specialists at BPI. Together, our sales and R&D teams help identify and develop the best possible solution for your application.

DO YOU HAVE ANY QUESTIONS?

Contact Henning to discuss your application and the next steps.



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