Habasit – Solutions in motion

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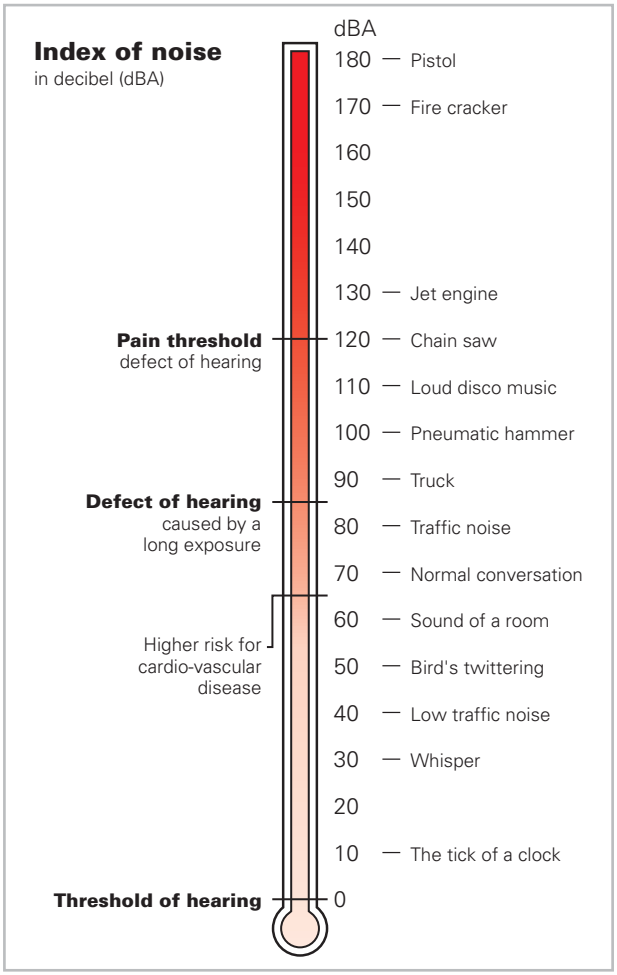
Noise in Processing Industries – a Link to Conveyor Belts

What are sound and noise?
Sound is what we hear. Noise is unwanted sound.

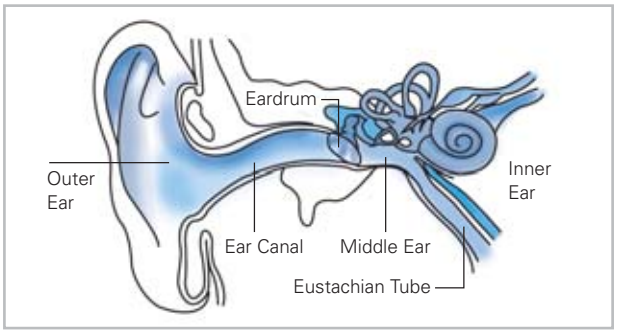
Sound is produced by vibrating objects and reaches the listener's ears as waves in the air or other media. When an object vibrates, it causes slight changes in air pressure. These air pressure changes travel as waves through the air and produce sound. The pressure difference of alternating regions of higher and lower air pressure is the so called **sound pressure**.



How are different sound or noise levels perceived?
Sound is perceived on a logarithmic scale. This means increasing sound pressure by a certain factor can be perceived as an equal step up in loudness. This is highly subjective. Therefore the rule of thumb is that if the sound pressure increases by steps of 10 dBA, the sound level is perceived twice as loud.

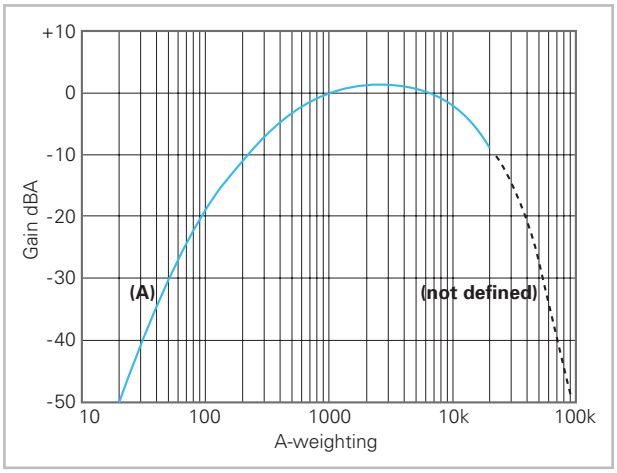
How is sound transmitted?
Once vibration, the source of sound, is present in a system it transports through mechanical coupling. The resonance of a structure may contribute to a machine's noise level.

Especially flat panels vibrate and are often the source of sound generation.



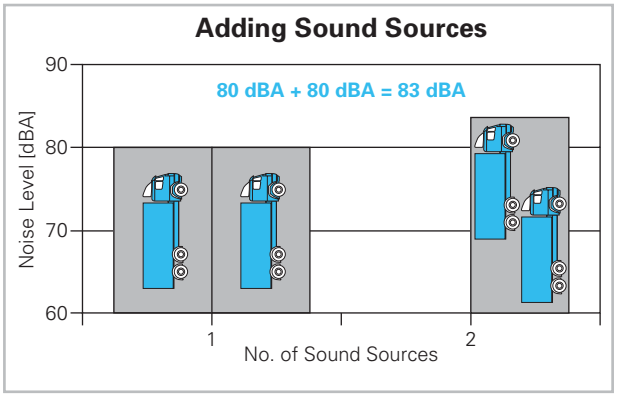
How is noise measured?
Sound perception is subjective. Therefore it is not easy to measure noise.

The most objective method is to measure the sound pressure in decibels (dBA) on a logarithmic scale. However since the sensitivity of the human ear to sound depends on the frequency, people hear some frequencies better than others. If a person hears two sounds of the same sound pressure but different frequencies, one sound may appear louder than the other. This occurs because people hear e.g. 1000Hz noise much better than low frequency noise (e.g. 100Hz).

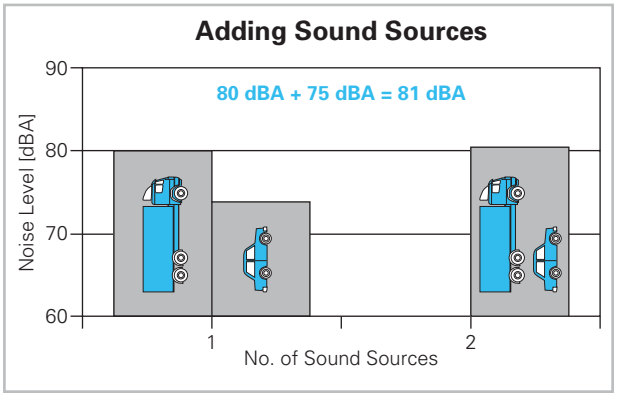


How do individual noise sources add up?

Example 1:
Take source 1 generating a noise level of 80 dBA. Then add source 2 with an equal noise level. The total sound level only moves up to 83 dBA, a difference that is noticeable.

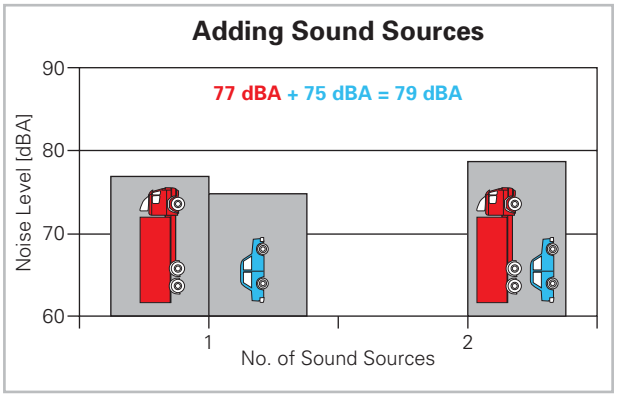


Example 2:
Add a 75 dBA noise source to an 80 dBA noise source. The total noise level is only 81 dBA. The difference is nearly discernible to the untrained ear.

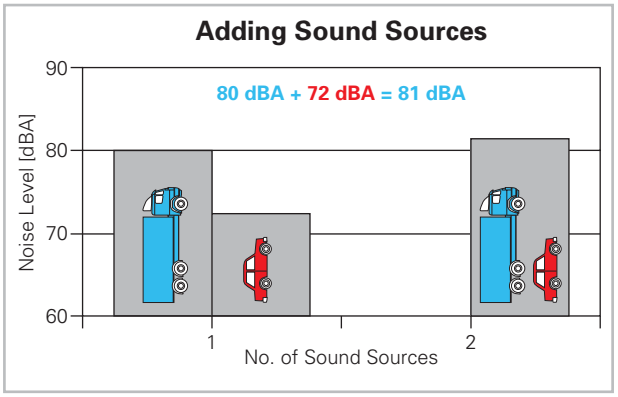


How is noise reduced effectively?
Take the values in Example 2. If the sound level of the stronger source gets reduced to the half (77 dBA), the total sound level is 79 dBA.

If on the other hand the weaker of the two sources is reduced to half the output (75 dBA to 72 dBA), the result is still 81 dBA (This figure is rounded. In precise figures it is a reduction from 81.2 dBA to 80.6 dBA).



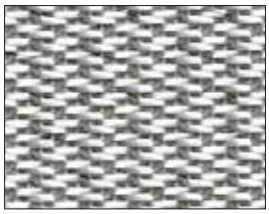
Conclusion
This means if you effectively want to reduce noise the loudest source in an "orchestra" of noise must be targeted. **In industry terms: In order to reduce overall noise, each noise element's level of sound must be identified and sorted according to loudness.**

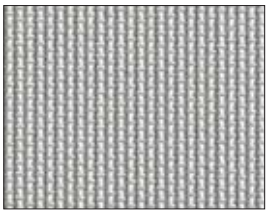


Noise generated by fabric conveyor belt
Repetitive patterns on moving belts, such as reverse side fabrics or embossing patterns can create oscillations.

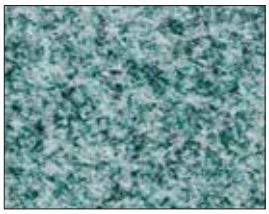
Consider these three factors when evaluating the effectiveness of a machine or a "noise generating device":
- oscillating energy **generated**
- how well oscillation is **attenuated** once it is generated
- how well vibrations of the machine are **transmitted** to the air

Various types of fabrics – Strong impact to noise generation


Cross twill fabric weave


Fine plain weave


Coarse plain weave

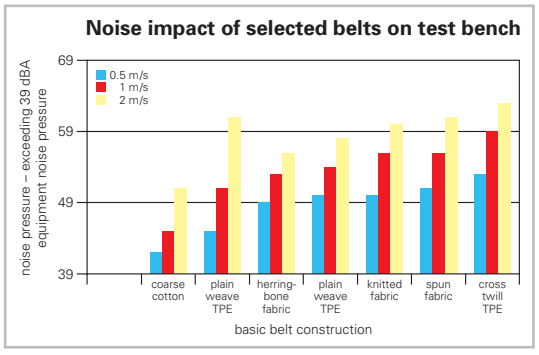

Non woven material


Knitware

Test measurement
In order to find out how much noise fabric conveyor belts generate and which belt constructions favor low noise running frequencies, Habasit conducted numerous measurements. As mentioned before, the environment and a machine design affect results, therefore the measurements cannot be taken at their absolute value. However, if all belts were tested under identical conditions, relative comparisons are valid.

Tests were conducted for a fabric-based belt on a slider bed and over a nose bar, since both generate noise differently. The test environment was performed in a sound – proofed (not dead sound) chamber to isolate the actual noise from background noise.

Summary of the test results
- Additional noise generated by fabric-based conveyor belts is relatively low compared to the noise coming from the equipment and other processing elements
- Noise levels on slider beds are generally low
- Nose bars generate a considerable amount of noise
- 1-ply construction is louder than multi-ply fabric-based belts
- Reverse side fabric has great influence on noise generated:
  – Slider beds: coarse fabric is usually better (damping effect)
  – Nose bars: coarse fabric is usually worse (more excitation, oscillation)
- Non-woven belts have very low noise levels
- Belts that are silent at slow speeds are mostly as well silent at high speeds



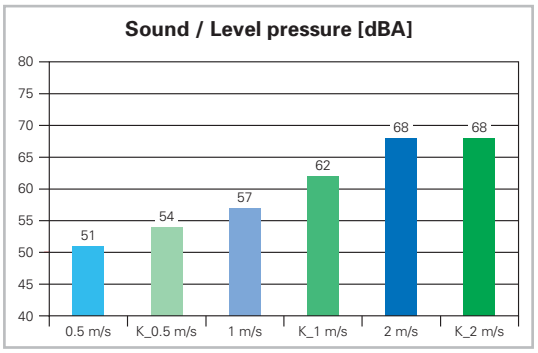
Conclusions: Belts and Conveyors

The Habasit solution

The test measurements indicate which belt type can be used to minimize noise. This is only one aspect in selecting a belt for an application. Therefore the most silent belt is seldom applied, due to additional processing demands, even though the noise level is lower and preferable. For example non-woven belts are very quiet, but due to their open textile surface not usable in many applications.

Based on this research Habasit does not and will not market a "one-and-only low noise belt". The measurements show that a belt is only one component in the noise generating system. Though some belt constructions are inherently better than others, it is not possible to offer one "noise proof" belt.

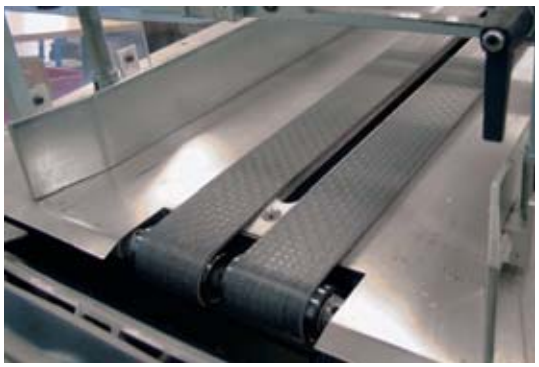
We at Habasit are determined to find the best possible solution which includes noise reductions, for a given set of application demands. Habasit continuously works with customers, OEMs, as well as end users, with this goal in mind.

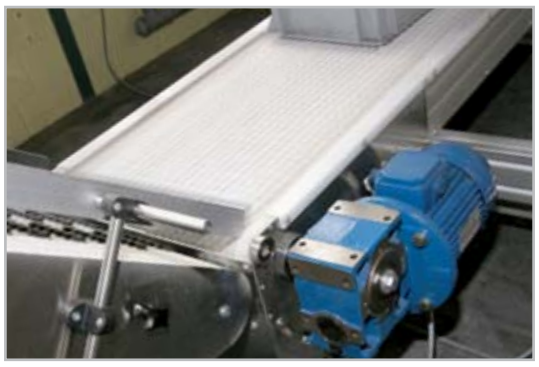


Sound level of one belt at 3 different speed levels; with nose bar (K) and without nose bar.

Recommendations for low-noise conveyor design

- Avoid generation of noise at the source (common origin: untrue running rollers, rumbling bearings, gearboxes)
- Restrict propagation of noise by using vibration damping elements / layers where necessary
- Avoid large resonating panels
- Lower resonance frequencies with heavy damping mats
- Encapsulate noisy parts of the machine
- A taut belt acts like a resonating drumhead; reducing belt tension / designing the equipment for low tensions may help lowering the noise level
- Use sound absorbing walls / elements in noisy rooms or areas.





Legislative impact

The European Union issued a directive on employee safety for those employees exposed to noise generated in industrial environments.
Conformance to this directive has become mandatory on February 15, 2006.
The directive documents "minimum requirements for the protection of workers from risks to their health arising … from exposure to noise and in particular the risk to hearing."
An obligation the employer has under the new directive is the following:

"Taking account of technical progress and of the availability of measures to control the risk at source, the risk arising from exposure to noise shall be eliminated at their source or reduced to a minimum."

Habasit has made the analysis and can help you to improve conveyor design as well as to select belts with limited noise impact.