.Kartesian
SPEAKER INNOVATOR

2 main criteria in product development

Kartesian loudspeakers integrate many innovations to keep very **low non-linearity on wide excursion** and improve the **transient response**.

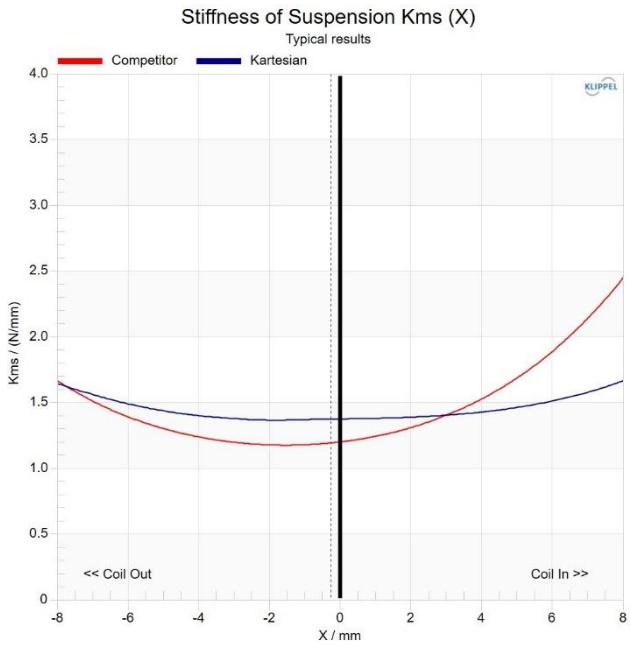
Furthermore, ach product is tested (measurements + listening session) into typical use case to ensure the sound quality is compliant with expectation.

Tolerances for linear excursion

In Kartesian standard, linear excursion is defined by the membrane movement where the force factor Bl (X), the compliance Kms (X) and the inductance Le (X) keep 80% of their nominal value.

This definition is much more demanding than the ordinary basic calculation: [(voice coil height) – (pole piece thickness)] / 2, but it is much more relevant.
1st, the usual calculation doesn't provide any real feature; even the force the factor cannot be defined with it.
2nd, it doesn't consider the suspension stiffness, which is very important.

Kartesian loudspeakers use innovative spiders (dynamiK, pumaX, progressive) to avoid these limitations.
<u>The measurements below illustrate this phenomenon with 8inch loudspeaker:</u>



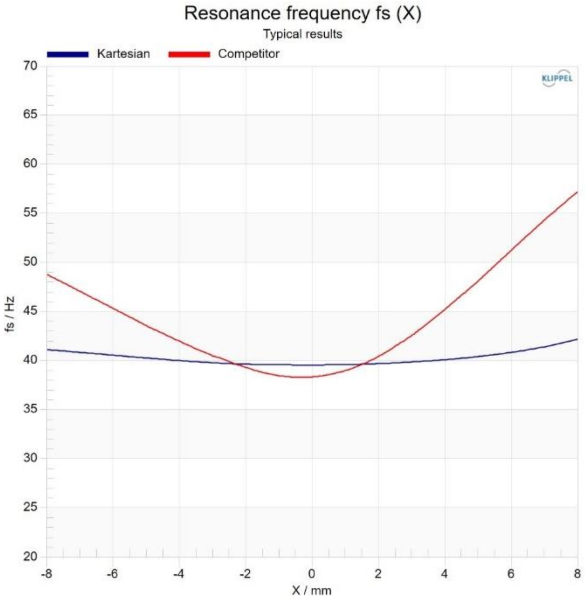
Both woofers claim similar Fr around 40Hz.
For the competitor, in red, the nominal stiffness is 1.2N/mm.
If we apply Kartesian tolerance standard of 20% variation, this woofer is only linear on +/-3mm (1.45N/mm at +3mm).
For the Kartesian woofer, in blue, the nominal stiffness is 1.4N/mm.
With the Kartesian tolerance standard of 20% variation, this woofer is linear on +/-8mm (1.65N/mm at +8mm).

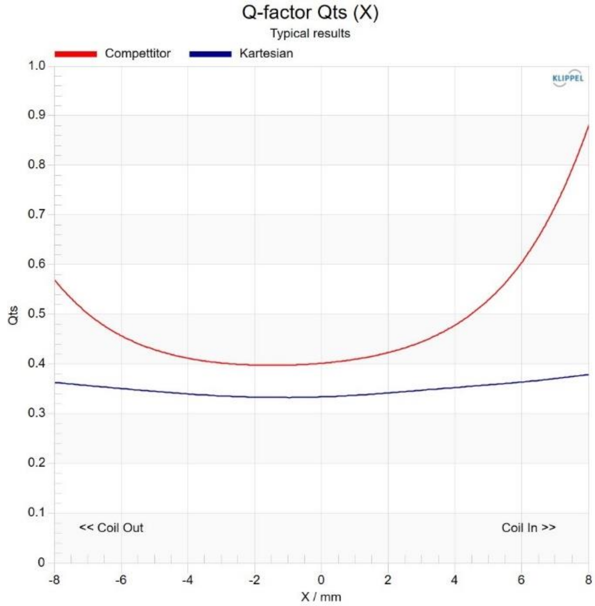
Playing bass with woofer reaching +/-3mm or +/-8mm linear suspension stiffness makes huge difference.

Demanding standard makes better products

<u>Most of the loudspeakers use conventional regular spider with 2 limitations:</u>

- Stiffness isn't symmetric over the rest position → An offset which creates harmonic distortion appears.
- Stiffness increases significantly over the rest position → The resonance frequency grows- up accordingly.





Due to suspension stiffness variation (increasing), the resonance frequency increase as well.
In red, the competitor has Fs very close to the expected 40Hz value, and it remains true over +/-4mm, considering 10% tolerance during the production assembling. Nevertheless, the Fs reaches 56Hz at+8mm excursion, which doesn't provide the same performances in low frequency anymore.
In blue, the Fs of the Kartesian woofer remains stable over the full excursion +/-8mm, ensuring same performances in any circumstances.

Due to Fs changing, the Qts is changing too.
In red, the competitor has Qts very close to the expected 0.4 value, and it remains true over +/-3mm, considering 10% tolerance during the production assembling. Nevertheless, the Qts reaches 0.9 at+8mm excursion, which doesn't provide the same frequency response in low frequency anymore.
In blue, the Fs of the Kartesian woofer remains stable (expected 0.32) over the full excursion +/-8mm, ensuring same low frequency response, whatever the excursion.

Quality control in production

1- During the production, we control the parts (cone, spider, voice coil, ...) before the assembling.
For each part, we take a percentage (defined with customer), and we measure the key points, such as the weight, coil height and R DC for the voice coil.

2- We control the magnetic field in the gap, at 4 points (every 90°), for 100% of the loudspeakers produced.
Excepted for the _vKi drivers where we control 8 points in the gap (every 45°).
This control ensures the magnetic field is homogeneous over the full circumference of the gap, avoiding rocking mode in large excursion.

3- The voice coil is positioned alone in the motor structure, with a Jigs dedicated to each speaker reference. This position has been defined in our R&D department, based on Klippel measurement, and it ensures to reach the optimal performances. After the voice coil is positioned in the motor structure, we assemble the spider, ensuring it is at its rest position, and next we assemble the cone and the surround, ensuring it is at its rest position too.
This assembling process is longer than the usual process, consisting of assemble all moving parts as sub-assembling (voice coil + spider + cone) and glue this sub-assembling in one time, on the frame. Nevertheless, Kartesian assembling process significantly improve the performance consistency during the production.

4- When the loudspeaker is assembled, we test it with sweep signal, from 0.5x its Fs to 20 000Hz (sweep duration =1.5s).
The signal amplitude is defined for each reference, to reach the required maximal excursion.
We keep each loudspeaker playing the sweep during 30 seconds, and we carefully listen is any rub & buzz noise appears.

5- If the loudspeaker succeeds all previous test, we move on the final QC test, where we measure:

- The frequency response
- The impedance
- The nominal sensitivity
- The THD
- The Mms, Bl and Qts
- The polarity

For every single loudspeaker produced, which succeed the final QC, there is a unique identification number, stored in our database.
This identification number, printed and sticked on each product, is linked with parts batch in our stock for full assembling traceability.