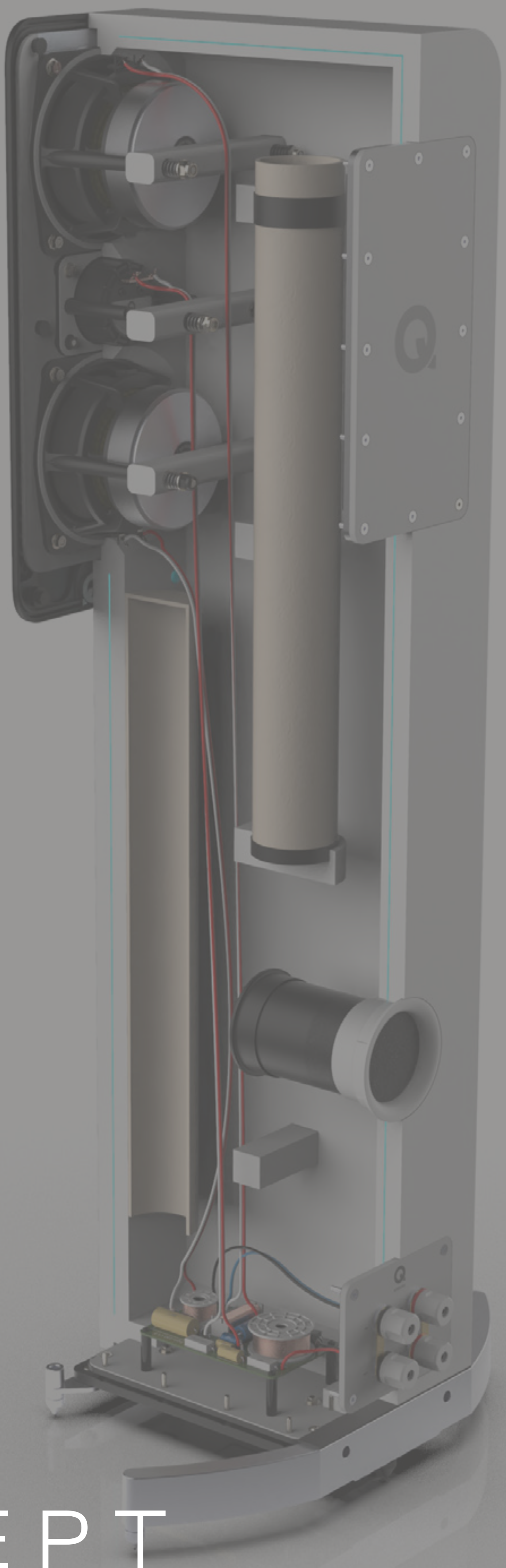
ACOUSTICS



CONCEPT SERIES

TECHNICAL INFORMATION

CABINET

P2P™ (Point to Point™) bracing

Q Acoustics Point to Point™ (P2P™) bracing is employed in the cabinets of Concept 30 and Concept 50.

P2P™ bracing is a cabinet bracing system that supports specific parts of the cabinet that need to be stiffened without coupling unwanted energy or exacerbating cabinet structure modality. P2P™ bracing will improve the focus of the stereo image and provide additional soundstage image.

The illustrations show how effective this methodology has become. A map of an un-braced Concept 50 cabinet wall with respect to its deformation at a test frequency of 564Hz is shown in Figure 1 below.

Where velocity is greatest the area is coloured towards the red end of the spectrum and where it is least it is coloured towards the blue end. Conventional bracing would allow this movement to be transferred to adjacent panels, but Q Acoustics' P2P™ allows the design team to apply bracing only in exactly the correct places.

When the test is repeated on the enclosure with P2P™ bracing in Figure 2, the deformation map shows how effectively the cabinet resonances have been reduced.

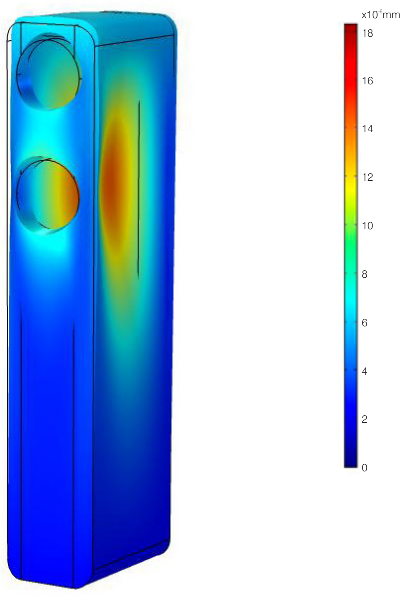


Figure 1

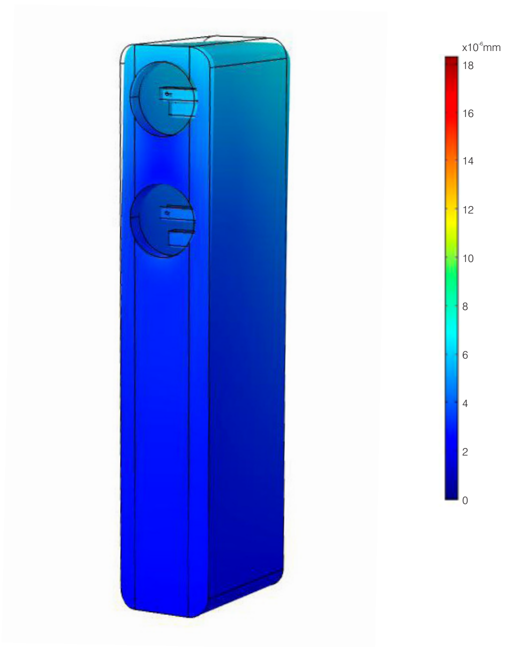


Figure 2

Gelcore cabinet walls

Whereas Q Acoustics' P2P™ bracing deals with lower frequency panel vibrations, higher frequency cabinet noise is dealt with by the use of Q Acoustics' Gelcore™ construction.

Any erroneous boost or cut in level at this frequency can affect the perception of musical timbre and contribute to listener fatigue.

A Gelcore™ loudspeaker cabinet is constructed in two separate layers as shown in Figure 3, the cutaway example below. The gaps between the layers are completely filled under pressure with a compliant form of non-setting gel. The constrained layer effectively damps the walls of the loudspeaker cabinet by converting higher frequency vibrations into heat, which is then dissipated harmlessly within the damping gel.

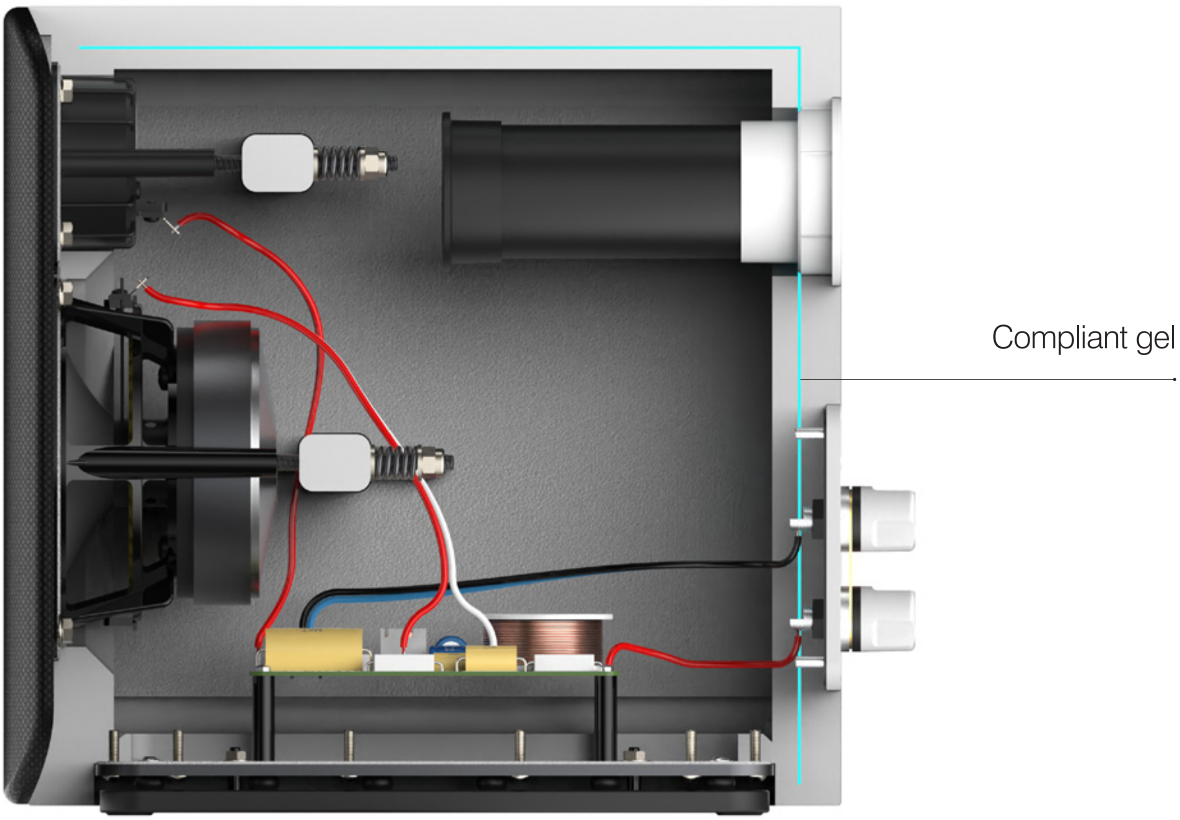


Figure 3

Aluminium baffle

The drive units are fixed to a double radius, highly stiff, 3mm thick, damped aluminium baffle plate which has been designed both in material and form.

Figure 4 shows the back view of the Concept 30 baffle plate. Studs, extending from the back of the drive unit chassis pass through the stiff P2P™ cross-braces (or for Concept 90 the cabinet back panel) and provide the fixings for this baffle assembly.

Whilst a cosmetically clean and acoustically smooth front baffle has been achieved, there are also technical benefits achieved from this construction methodology. Figure 5 shows an internal view of the Concept 30 cabinet. The studs are pretensioned to give the correct cabinet acoustic seal whilst minimising the structural coupling of the baffle assembly in the main cabinet assembly.

In addition to the smooth low acoustic diffraction profile of the baffle, the geometric curvatures provide high stiffness for relatively low material mass, thus pushing the fundamental baffle resonance well away from the main excitation of the woofer. The tweeter is dynamically isolated from the baffle.

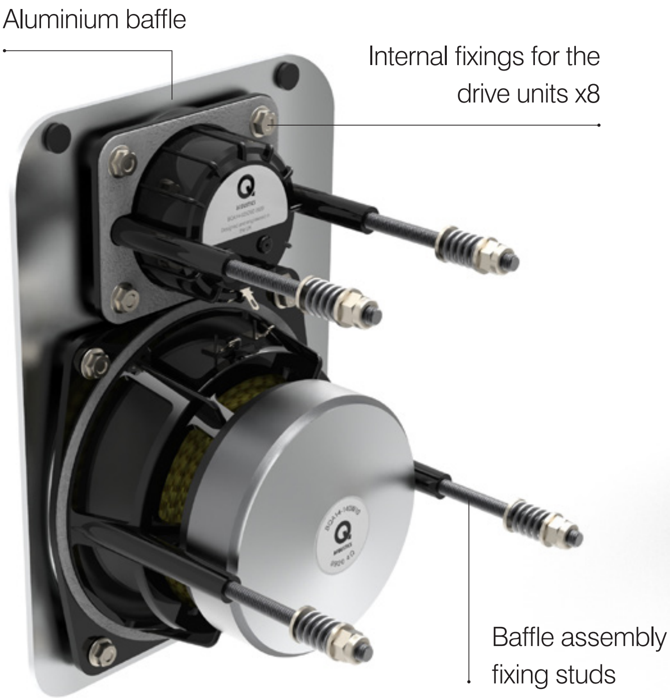


Figure 4

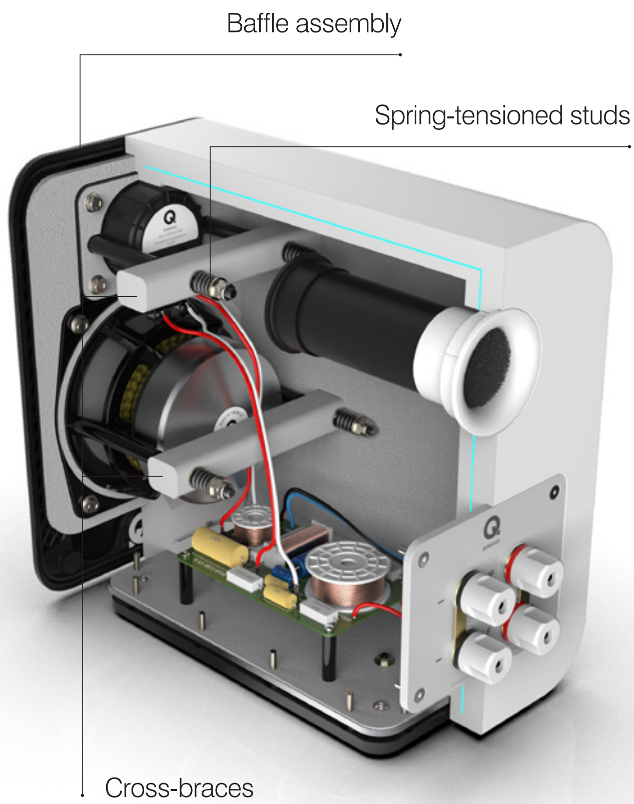


Figure 5

Cabinet base

All three models feature Q Acoustics' Isolated cabinet base to mechanically isolate the loudspeaker from unwanted vibration ingress and to reduce leakage or vibration to external surfaces.

Figure 6 shows this arrangement in detail. The isolated base is a dual plate design where the upper plate fixes to the base of the loudspeaker and the lower plate, spaced by a suspension system, couples to the floor. The suspension is formed by fourteen independent moulded spheres. The shape of the isolation spheres stabilises the loudspeaker whilst allowing the compliance to be tuned independently in the axis of the drive units.

This isolation principle works well because the cabinet has a large mass and therefore high cabinet-inertia. The cabinet therefore acts as a mechanical "ground" giving the drivers an extremely stable platform from which to accelerate correctly. Lightweight cabinets would not provide sufficient grounding and so the isolated base would not be so effective. At higher frequencies where the structural wavelengths are comparable to the dimensions of the cabinet, so called "bending" (or flexural) waves are propagated transversely across its surface and it is these that are isolated from the stand/floor.

With the isolated base transients become immediately tighter and stereo imaging ability is improved, bringing greater depth and focus to the performance.

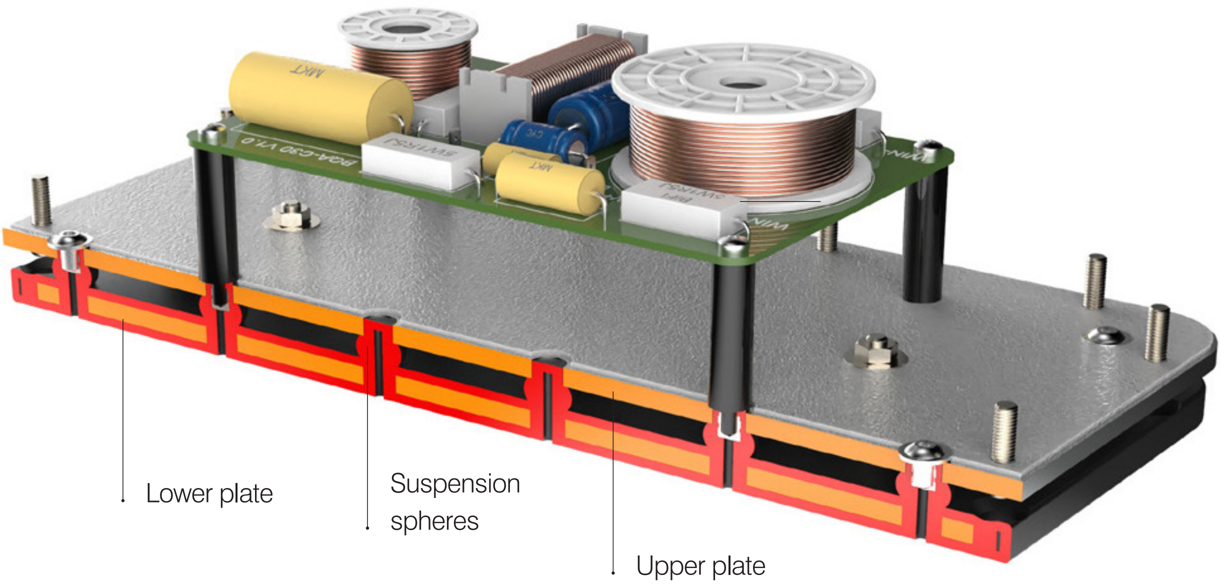
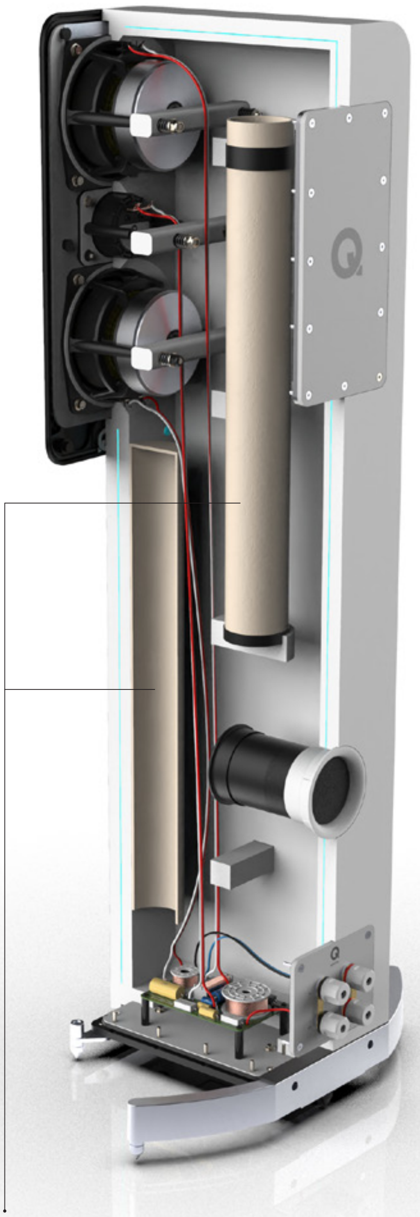


Figure 6

HPE™ (Helmholtz Pressure Equalizer™) tubes

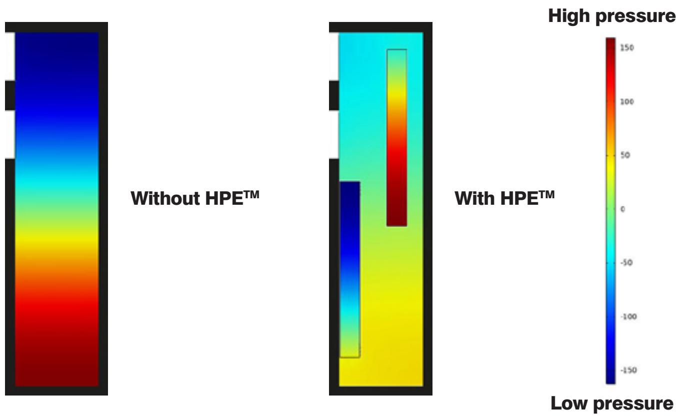
The tower design of the Concept 50 can introduce undesirable standing waves within the cabinet. Concept 50 therefore includes HPE™ (Helmhotz Pressure Equalisers™) designed to convert pressure to velocity and reduce the overall pressure gradient within the loudspeaker enclosure.

The cutaway in **Figure 7 (below)** shows the installation of HPE™ technology in the cabinet.



HPE™

Figure 8 (below) shows a pressure map of a Concept 50 cabinet with and without HPE™ at 182.4Hz.



The benefits of the HPE™ technology can be clearly seen in the frequency response curves. **Figure 9 (below)** shows the frequency response measured without HPE (note the dip at 182Hz).

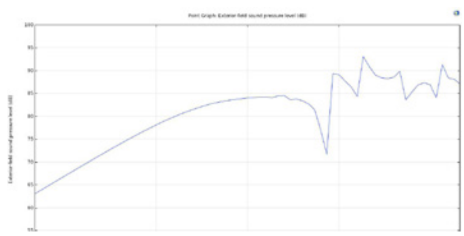
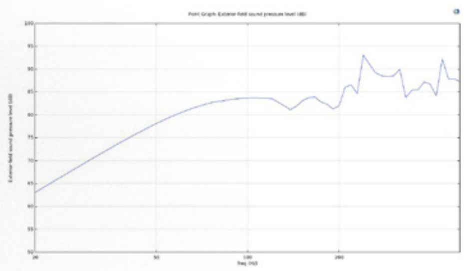


Figure 10 (below) shows the frequency response with HPE™. The dip at 182Hz is now resolved.



DRIVE UNITS

Designed as an integral part of the mechanical structure of the cabinet, both the mid/bass and tweeter drivers are new, ground-up designs specifically for the Concept 30, 50 and 90 loudspeakers.

The die-cast chassis of both drive units are employed as part of a rigid structural framework at the front of the cabinet, locking the baffle to the cabinet brace using fixings built into the drive unit chassis.

Mid/Bass drive unit

The substantial die-cast chassis mounts directly to the aluminium baffle and carries a 100 mm x 20 mm magnet, as shown in Figure 11.

The large, 30.5 mm voice coil increases motor strength resulting in a 50% increase in power handling over a comparable driver with 25.4 mm voice coil. The voice coil is wound from copper-clad aluminium wire (CCAW) over a glass fibre former. Despite the large diameter, the lightweight CCAW wire keeps the moving mass low while the non-conductive former completely eliminates eddy currents which can otherwise be induced in aluminium voice coil formers.

The low damping, pure nomex spider results in good dynamic behaviour, especially for small signals. Finite Element Analysis (FEA) computer modelling techniques were used to optimise the design of the spider and surround for a symmetric compliance characteristic and to achieve best alignment of the suspension with the new motor system.

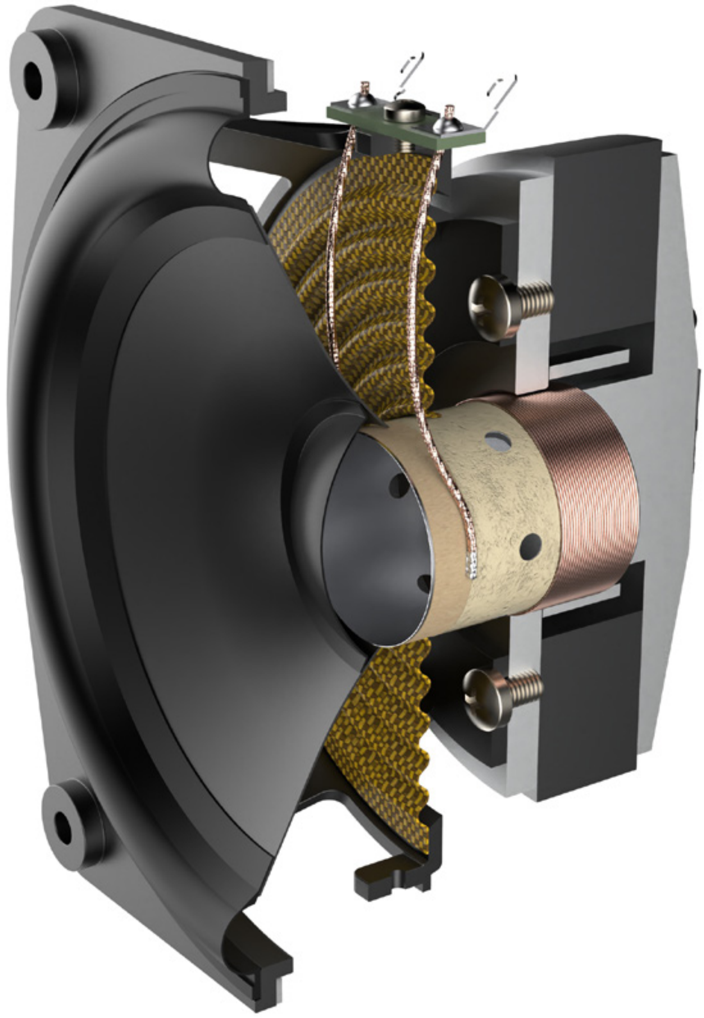


Figure 11

Mid/Bass drive unit (continued)

The measured Bl(x) and Cms(x) graphs shown in Figures 12 and 13 prove that the targeted design goals have been achieved.

The mid/bass driver includes a copper cap on the pole-piece for reduced motor-induced 3rd order harmonic distortions. Figure 14 shows THD measured at 90dB output level.

To complete the design, an aluminium demodulation ring is mounted underneath the pole-plate for reduced inductance induced modulation distortion. In Figure 15 the measured coil inductance L(x) is plotted as a function of excursion. The symmetrical shape of this plot confirms that the Concept mid/bass driver performs well in this regard.

The cone material and geometry, the voice coil construction and the FEA optimised suspension system are all design features inherited from the Concept 500 mid/bass driver.

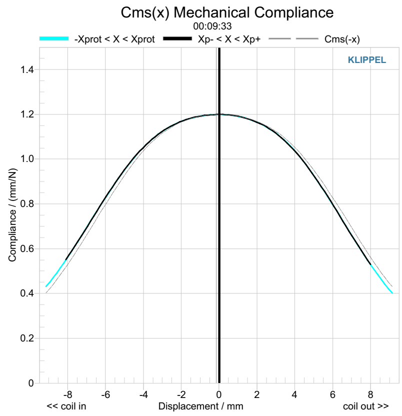


Figure 12

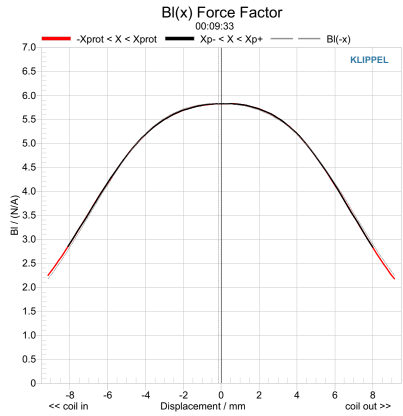


Figure 13

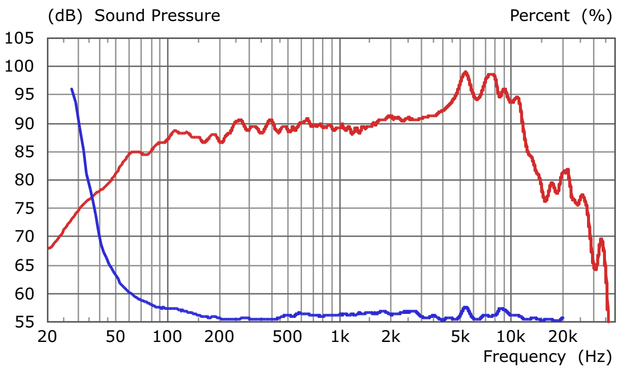


Figure 13

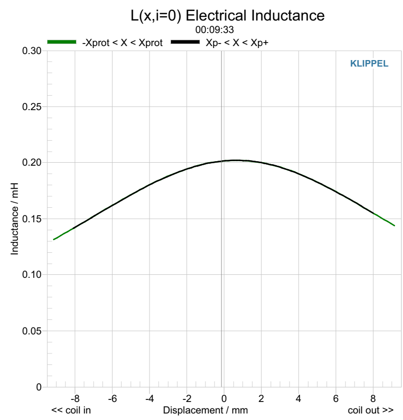


Figure 14

High frequency drive unit

The cutaway in Figure 16 shows the tweeter is built on a die-cast chassis which is fully hermetically sealed and mechanically isolated (floating) from the front baffle.

The motor system is a compact neo-motor to minimise the spacing within the drive unit array of the Concept 50 and 90.

The design features optimised acoustic rear wave termination from inside and outside the voice coil diameter. The back chamber is carefully vented for lower distortion in the cross-over region.

Designed with a 700 Hz resonant frequency the bandwidth of the tweeter is optimised to allow a low crossover point close to 2kHz. This maximises the off axis performance of the MTM (Mid Woofer-Tweeter-Mid Woofer) design of Concept 50 and Concept 90 and maintains phase consistency for seamless integration through the crossover region. Figure 17 shows the on-axis SPL and THD measured at 90dB/1m.

A measured THD value of less than 0.5% for frequencies above 1.5kHz confirms that this is a low distortion, high excursion tweeter well suited to a low crossover frequency.

The concave roll-surround design delivers a broader directivity and phase-coherent off-axis radiation.

A shallow wave guide improves the directivity of the tweeter in the 5-15kHz region as shown in the directivity diagram in Figure 18.

The dome fabric, compact neo-motor, symmetrical load cavity and inverted roll surround are all design features inherited from the Concept 500 tweeter.

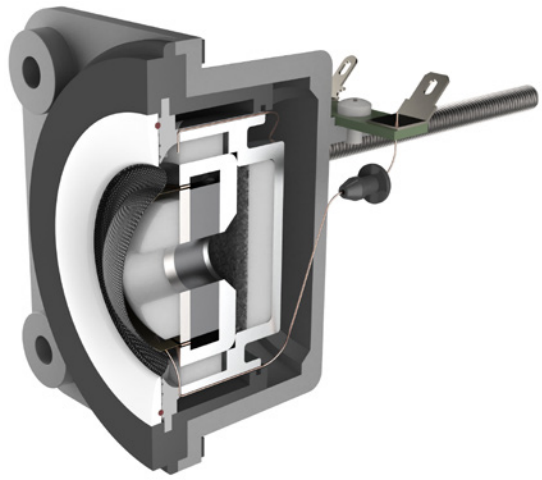


Figure 16

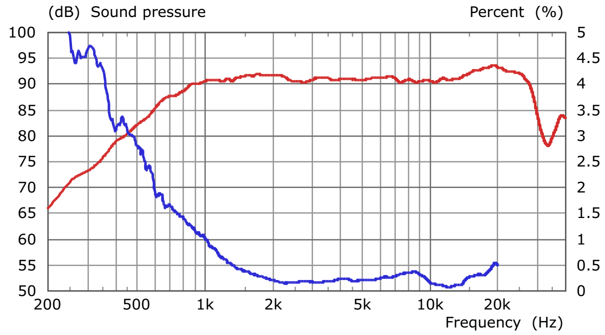


Figure 17

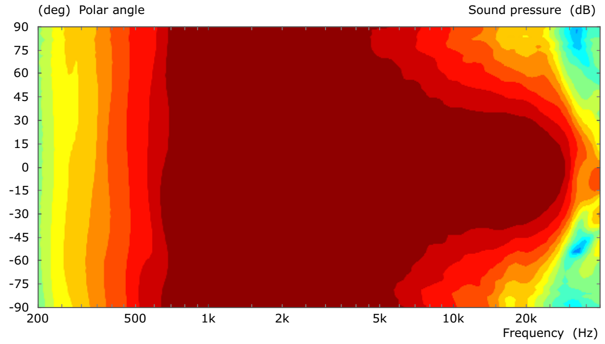


Figure 18

CROSSOVER

Crossover

The crossover is a modified 2nd order design with crossover point set at 2.4 kHz for the Concept 30 and 2.1 kHz for the Concept 50 and Concept 90. This improves integration in the latter two MTM designs. The load impedance is set at a nominal 6 ohms.

The crossover uses high grade metallized polyester film capacitors and zero saturation air core inductors in the signal path. The resistors are high power wire-wound types, bifilar wound for ultra-low parasitic inductance.

The crossover is mounted away from electro-magnetic fields radiated by the drive units on the isolated base of the loudspeaker (Figure 19). The isolated base serves to minimise any microphonic pickup in the crossover components that would be induced by cabinet vibration.

The base is constructed from a non-metallic paper loaded phenolic resin sheet to prevent the induction of eddy currents by the adjacent crossover which could otherwise occur in a metal base.

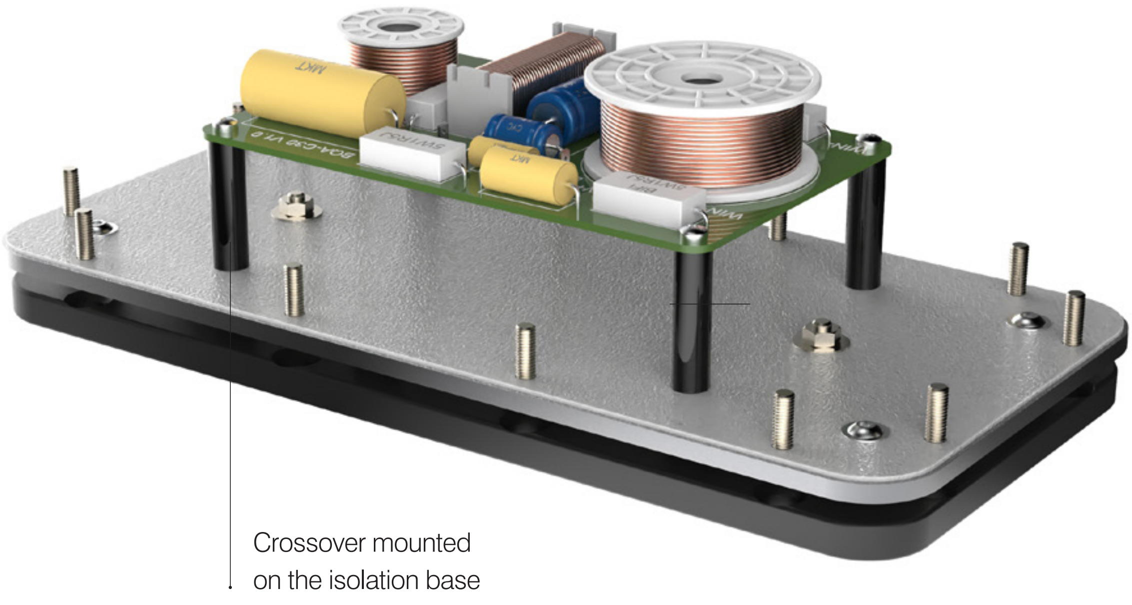


Figure 19

TERMINAL PANEL

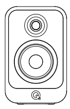
Terminal Panel

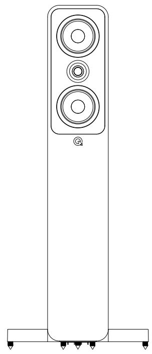
The bi-wirable input terminals are machined from solid copper then nickel plated for low contact resistance and to prevent tarnish. The terminal panel is machined from non-metallic PMMA as shown in Figure 20.

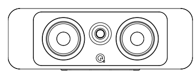
Figure 20

SPECIFICATIONS

Specifications







	Concept 30	Concept 50	Concept 90
Bass unit	1 x 125 mm (5.0 in)	2 x 125 mm (5.0 in)	2 x 125 mm (5.0 in)
Treble unit	1 x 25 mm (0.9 in)	1 x 25 mm (0.9 in)	1 x 25 mm (0.9 in)
Frequency response (-6dB)	54 Hz - 30 kHz	42 Hz - 30 kHz	67 Hz - 30 kHz
Nominal impedance	6 Ω	6 Ω	6 Ω
Minimum impedance	3.9 Ω	3.6 Ω	3.7 Ω
Sensitivity (2.83V @ 1kHz)	87 dB/w/m	90.5 dB/w/m	90 dB/w/m
Recommended amplifier power	25-100 W	25-150 W	25-150 W
Crossover frequency	2.4 kHz	2.1 kHz	2.1 kHz
Distortion (120Hz - 20kHz, @2.83Vrms)	<0.2%	<0.2%	<0.2%
Effective volume	7.0 L	28.8 L	11 L
Dimensions HxWxD (per loudspeaker)	284 x 180 x 319 mm (11.2 x 7.1 x 12.6 in)	Inc spikes and stabiliser: 1025 x 418 x 319 mm (40.4 x 16.5 x 12.6 in) Cabinet width: 180 mm (7.1 in)	184 x 550 x 259 mm (7.2 x 21.7 x 10.2 in)
Weight (per loudspeaker)	7.9 kg (17.4 lbs)	22.9 kg (50.5 lbs)	12.3 kg (27.1 lbs)

ACOUSTICS

CONCEPT SERIES

Discover more and experience the Concept Series in Augmented Reality (AR) in your home.