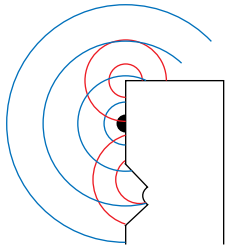
"The world should experience the performance of this exceptional loudspeaker."
—Matthias Böde, STEREO Magazine, January 2008

Cabinet

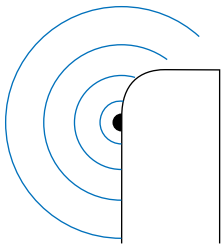
The cabinet plays an enormously important role in the quality of music reproduction, and so the engineering of the CS3.7's cabinet incorporates several innovations that contribute to the speaker's stunning clarity, its utter tonal neutrality and its exceptionally realistic imaging.

The cabinet's most important function is to completely contain the energy generated by the drivers to the inside of the cabinet. If even a miniscule amount of this internal energy escapes through vibration of the cabinet walls, distorted sound will be generated that will obscure the music's delicate details. Cabinet wall motions of even one ten-thousanths of an inch or less will produce audible distortion, and so it is very important that all cabinet walls are as strong and rigid as possible. In this regard the CS3.7 performs extraordinarily well, with all the cabinet elements innovatively engineered to provide exceptional rigidity.

Reducing Diffraction



This diagram illustrates how energy from the tweeter (blue) is diffracted from cabinet edges and a nearby driver cavity (red).



Here it is illustrated how the CS3.7's rounded baffle edges and flat midrange diaphragm allow the tweeter's energy to leave the cabinet without being diffracted.

Another task the cabinet must perform is to allow the sound from the drivers to radiate freely without encountering cabinet edges or cavities that will diffract some of the energy, causing interference and delayed sounds that produce tonal colorations and obscure spatial information. In this regard, the CS3.7 provides exceptional results with its gently rounded cabinet top and sides.

Yet another cabinet function is to position all the drivers properly so that the listener hears the sound of each driver at the same time. The CS3.7's sloping front is designed to achieve time coherence between the sonic output of the woofer and the midrange/tweeter array.

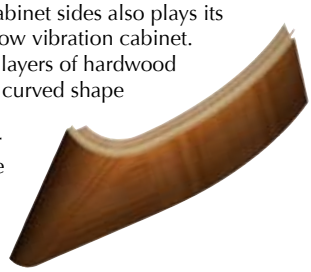
And finally, the cabinet should avoid cavity resonances and standing waves in its internal spaces. Here also, the CS3.7 performs well, with the curvature of its sides and top, along with its angled baffle, presenting virtually no parallel walls.

The speaker's front baffle is machined from aluminum, a material more than 30 times as strong as the usual MDF. In addition to reducing unwanted vibrations, aluminum also provides a rigid mounting of the drivers so they cannot move, even a miniscule amount, in recoil from the forces they generate to accelerate the diaphragm (every force has an equal and opposite force).

The baffle's sloping angle positions the drivers for proper time coherence.

The cabinet top is made of die-cast aluminum whose shape provides several important advantages. First, it provides enormous strength, virtually eliminating unwanted vibration. Also, its rounded shape around the midrange eliminates diffraction of energy from the midrange and tweeter. In addition, the rounded shape helps minimize resonances within the cabinet.

The construction of the cabinet sides also plays its part in the CS3.7's rigid, low vibration cabinet. The sides are made of 15 layers of hardwood laminated together into a curved shape under high pressure. This results in a much stronger panel than usual, with the curves adding greatly to its rigidity. The rounding at the front of the speaker also reduces unwanted diffraction, and the gentle rounding along the cabinet sides creates non-parallel walls to minimize internal resonances.



"In a word: stunning."—Brett Gideon,
TONE Magazine, New Zealand, January 2008

The THIEL CS3.7

The cabinet top is made of die cast aluminum into a shape that provides dramatically improved vibration reduction, the practical elimination of diffracted driver energy and the reduction of internal standing waves. Less vibration contributes to greater clarity, while the absence of diffraction allows for very open, boxless reproduction.

The tweeter is coincidently mounted with the midrange so the two drivers are perfectly time coherent for every listener position and so every trace of lobing is vanquished. This driver mounting system ensures that you will always hear the sound with perfect timing and synchrony, creating a sense of realism unachievable by any other means.

The midrange driver incorporates a radically new diaphragm geometry that provides incredible rigidity and achieves perfect pistonic motion to the limits of audibility. The diaphragm's flat shape also eliminates any altering diffraction of the tweeter's output.

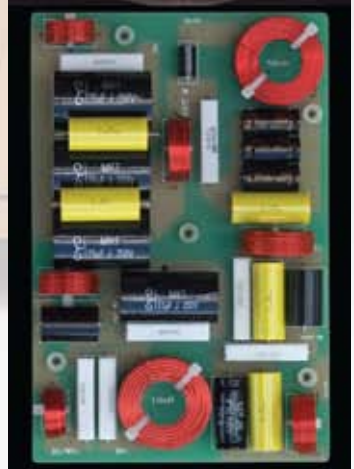
The cabinet sides achieve great stiffness by a construction of 15 hardwood plies formed together into a curved, thick panel. This construction preserves the nuances and delicacy of the music by reducing unwanted sonic artifacts that would obscure musical detail.

The cabinet front is sloped to provide time coherence between the woofer and the mid/tweeter array, preserving music's timing information. Because all the discrete harmonics that make up the musical sounds are heard in perfect synchrony, all the music's spatial cues are reproduced naturally.

The 3.7's front baffle is machined from aluminum to provide great rigidity against unwanted vibration and to provide a very hard and rigid mounting for the drivers, practically eliminating recoil motions of the drivers. Such a rigid mounting system retains delicate information lost in most speakers.

The woofer's diaphragm contributes to extended bandwidth and high while its very large magnet powers the copper stabilized, long gap motor that achieves distortion levels only one-tenth the usual. The result is tonal, effortless, and solid low frequencies.

The sophisticated crossover network provides complete phase coherence of the musical harmonics so that the music's waveforms are preserved, while also providing uniform energy response and exceptionally neutral tonal response. The result is astonishing clarity, transparency, and true three-dimensional realism you may not have known was possible.



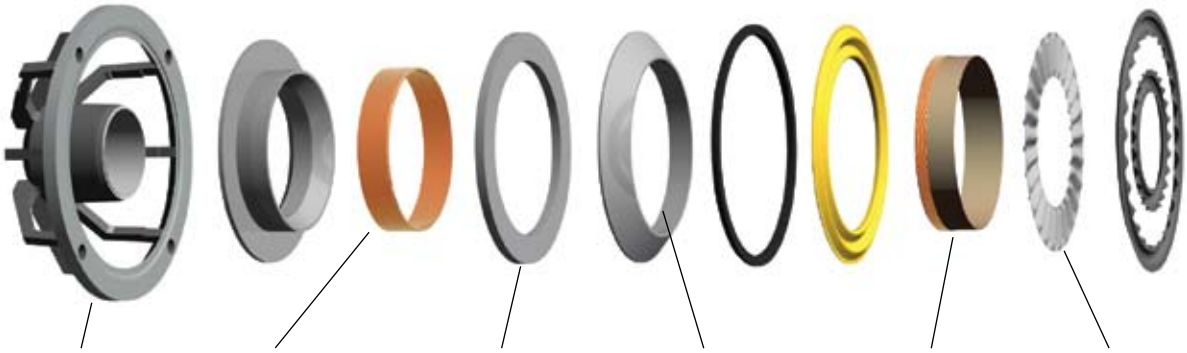
CS3.7 Components

The Midrange Driver should, of course, precisely reproduce every musical nuance while introducing not even a trace of its own colorations or distortions caused by diaphragm resonances or electromagnetic nonlinearity. The most exciting innovation in the CS3.7 is a new midrange diaphragm that advances midrange performance much closer to this ideal.

The midrange driver's diaphragm is constructed with an entirely new shape that provides far greater stiffness than typical diaphragms, even those made from exotic materials. The diaphragm is shaped with corrugations that are oriented from the center outward (like spokes) and act a little like small I-beams to provide enormous strength in that direction. The large diameter voice coil attached to the diaphragm gives it strength in the other direction – around the circle. This design achieves such great stiffness that the diaphragm continues to vibrate perfectly, as one unit, all the way up to 20 kHz, usually considered the upper limit of human hearing. Such fabulous vibrational behavior is unprecedented and allows the CS3.7 to achieve a purity and delicacy of the high frequencies that is truly extraordinary.

This new diaphragm geometry also has a second important benefit that derives from its shape. The diaphragm is basically flat and therefore has virtually no detrimental effect on the tweeter's output, unlike a normal cone shaped diaphragm that alters the sound of a tweeter mounted in its center.

Anatomy of a midrange driver



The die-cast chassis rigidly holds the tweeter and midrange in perfect alignment and virtually eliminates transient-robbing subtle vibrations of the motor system.

A copper sleeve around the center magnetic pole stabilizes the strength of the magnetic field and reduces the voice coil's inductance non-linearity.

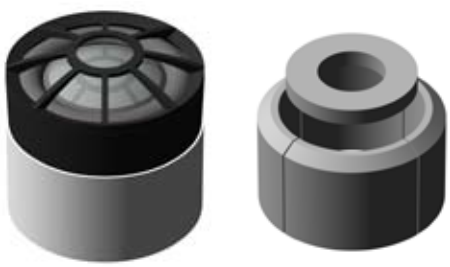
An extremely powerful neodymium magnet powers a very large and deep magnetic gap so the driver can achieve both very high efficiency and high level, low distortion output.

The wide magnetic gap, in conjunction with the short-winding voice coil provides much lower motor distortion compared with common short-gap designs.

The very large diameter voice coil contributes exceptional circumferential strength to the moving system while providing high power handling and very low power compression.

The unique diaphragm shape provides unprecedented stiffness and therefore unprecedented, resonance-free operation.

The Tweeter provides much lower distortion and higher output than any other tweeter we are aware of. This is accomplished in spite of a size small enough to mount coincidently with the midrange driver by a unique long gap motor system that uses a set of four radial and one axial neodymium magnets with a total weight six times that of a typical neodymium powered tweeter. In addition, the tweeter provides the complete absence of any coloration-producing diaphragm resonances in the audible range, a very wide operating bandwidth and very low power compression. The result is high frequencies of utter neutrality and effortless dynamics.



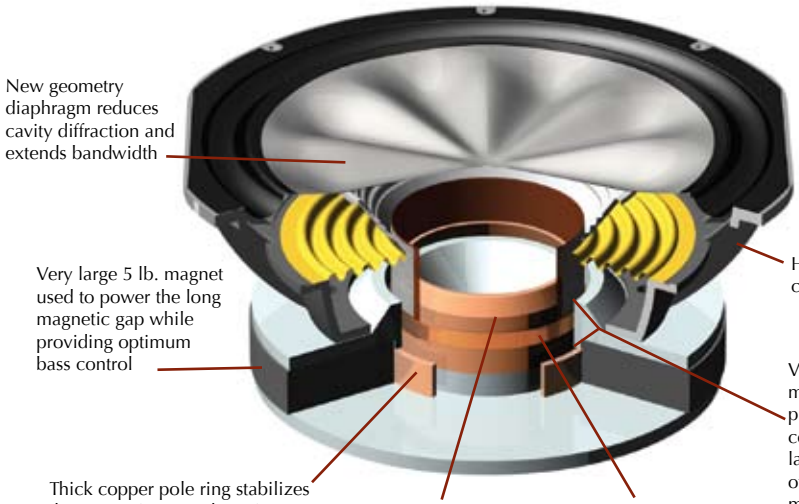
A set of four radially-magnetized and one axially-magnetized neodymium magnets have a total weight of 2.3 oz. (64 grams), six times as much as usual neodymium powered tweeters.

"The speaker literally 'melts' into the soundstage. You are never aware that the sound is coming from two boxes in front of you . . ." —James Tanner, Bryston Electronics

The Woofer also utilizes

an innovative diaphragm that is basically flat and therefore reduces the diffraction of the midrange energy usually caused by the woofer's conical cavity. The massive magnet powers a very high output and low distortion long magnetic gap, and distortion is further reduced by the use of a heavy copper pole ring and a copper pole sleeve that reduces inductance nonlinearity. The large 3 inch diameter voice coil allows high power handling.

The very low frequencies are augmented by a passive bass radiator diaphragm which avoids the resonance and noise problems of a ported enclosure.



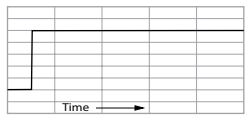
The Crossover is a true

first order acoustic type that provides the utmost in spatial and depth imaging performance as well as overall realism. This is the only type of crossover that provides complete accuracy of amplitude, phase, time, and energy, and therefore the only type that does not distort the musical waveform. Proper application of this gradual-transition type of crossover requires the use of more expensive drivers with wider frequency ranges than are required for use with common quick-transition crossovers, but the benefits also include improved uniformity of the speaker's output in all directions.

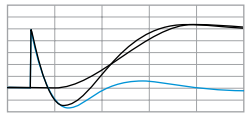
The crossover is meticulously engineered to achieve extreme tonal neutrality and is constructed with extensive use of polypropylene and custom polystyrene capacitors.

Phase Coherence

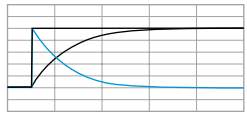
This graph shows the ideal response to a step signal, which like music, contains harmonics with phase and time relationships.



This graph shows how the woofer signal (red) and the tweeter signal (blue) from the common 4th order crossover add to produce a distorted waveform (black).



This graph shows how the woofer and tweeter signal from a 1st order crossover combine to reproduce the waveform of the input signal.

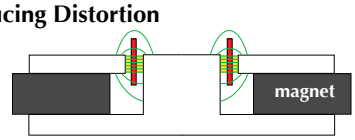


Reducing Distortion

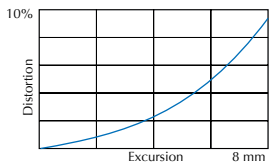
Most speaker distortion is produced because the voice coil experiences changes in the magnetic strength as it moves forward and back to produce sound — changes that are caused because the ends of the coil become farther from the magnetic gap where the magnetic field is strongest.

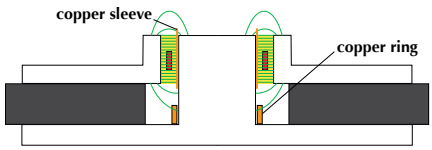
By contrast, in the THIEL long gap system, all of the short coil is always within the long magnetic gap, and therefore the coil does not experience changes in magnetic strength as it moves. Because the magnetic field is constant throughout the coil's motion, distortion is greatly reduced. These long gap/ short coil, copper stabilized systems do require much larger magnets, but they produce less than one-tenth the distortion of conventional drivers.

In addition, all THIEL drivers use a copper sleeve around the central magnetic pole that reduces inductance distortion and the woofers also use a thick copper ring that stabilizes the strength of the magnetic field during long, high power excursions. These distortion reducing methods result in noticeably greater purity of sound and result in more effortless dynamic reproduction.

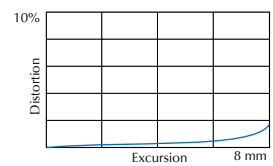


In a conventional magnet system, the coil (red) is longer than the magnetic gap (yellow) and therefore enters a weaker field (green) whenever it travels from its rest position. This changing field strength produces distortion.





In THIEL's long gap design, the shorter coil remains within a long uniform field as it moves through its entire range, drastically lowering distortion.



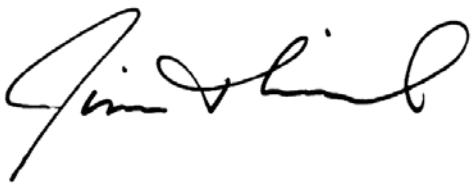
The enjoyment of music is a uniquely rewarding and inspiring human experience.

Profound beauty and subtle emotions can easily be evoked by a great performance of great music. At THIEL, our passion is to provide this experience for our customers and, therefore, our standard of speaker quality is fidelity to the music – a complete and perfectly accurate translation of the musical signal. This is what motivates me – to develop loudspeakers that preserve precise sound character, provide resolution of the most subtle musical details, reproduce an accurate three-dimensional representation of the performance, and provide a realistic recreation of the dynamic contrasts in music.

Achieving this level of performance is made more challenging because, while some aspects of speaker performance can be measured and described by specifications, other important aspects cannot, and achieving the highest level of performance in these respects is often even more difficult. In other words, while great specifications are necessary for great performance, they are not sufficient – there is much more to music and its reproduction than can be captured by a few numbers.

For the CS3.7, my goal was to achieve a level of performance greater than any previous product by incorporating everything we have learned and every innovation we have developed over the last 30 years, and then adding some exciting new ideas to overcome limitations of previous designs.

I hope you find the CS3.7 speakers as rewarding to listen to as they have been for me to develop.



Performance Summary

The CS3.7 achieves the following major performance attributes:

- Extremely accurate tonal response achieved by exceptionally accurate frequency response, very low diffraction, and elimination of significant resonances. Octave-averaged response is within ±0.5 dB.
- Very high resolution of detail achieved by drastic reduction of audible diaphragm resonances, very non-resonant, sonically inert cabinet, time coherence, extensive use of premium quality polystyrene and polypropylene crossover capacitors and numerous other details of design, engineering, and construction.
- Truly realistic and natural imaging provided by complete elimination of phase distortion (true minimum phase response), time coherence, exceptionally wide and even dispersion of energy at all frequencies enhanced by first-order crossover system, low diffraction, and very low levels of delayed resonant energy.
- Preservation of dynamic contrasts achieved by very low driver distortion, high efficiency, very low delayed energy storage, and very low power and thermal compression.

THIEL CS3.7 in Morado finish with optional Outriggers.

Specifications

Driver complement:

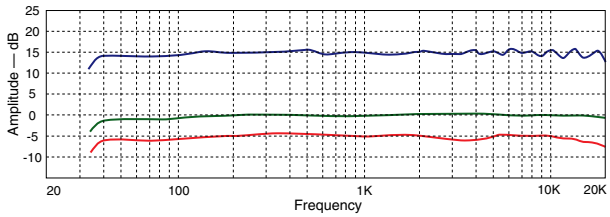
Tweeter: 1 in. (2.5 cm) aluminum dome, 64 g (2.3 oz.) neodymium magnets, copper pole sleeve, short coil/ log gap design with 3 mm Xmax, coincidently mounted with midrange

Midrange: 4.5 in. (11.5 cm) with wave-shaped aluminum diaphragm, 3 in. diameter voice coil, 115 g (4 oz.) neodymium magnet, copper pole sleeve, short coil/ long gap design with 6 mm Xmax, die-cast chassis

Woofer: 10 in. (25.4 cm) with wave-shaped aluminum diaphragm, 3 in. diameter voice coil, 5 lb. (2.27 kg) magnet in a 13 lb. (5.9 kg.) structure, copper pole ring, copper pole sleeve, short coil/ long gap design with 14 mm Xmax, die-cast chassis

Passive Bass Diaphragm: 10 in. (25,4 cm) wave-shaped diaphragm

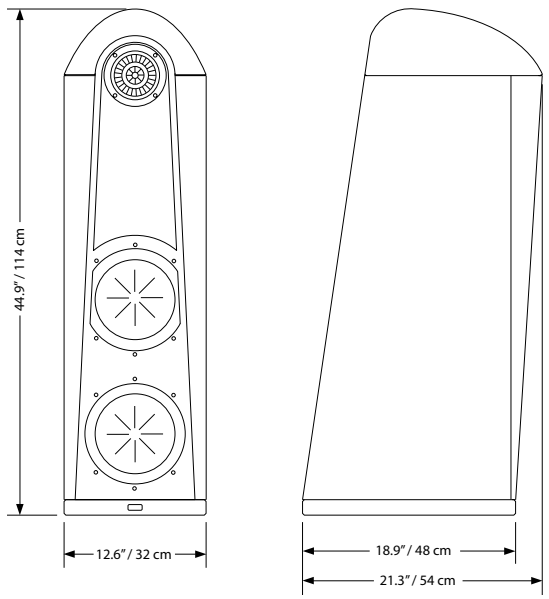
Bandwidth (-3 dB)	32 Hz - 35 kHz
Frequency response	33 Hz - 26 kHz ±2 dB
Phase response	minimum ± 10°
Sensitivity (2.8v - 1m, true anechoic)	90 dB
Impedance	4 ohm (2.8 ohm min)
Recommended power	100 - 600 watts
Size (w x d x h)	12.5 x 21 x 45 inches (32 x 53 x 114 cm)
Weight	91 lb (41.5 kg)



The blue graph is the on-axis anechoic frequency response.

The green graph is the octave-averaged on-axis response. This correlates with perceived tonal balance.

The red graph is the octave-averaged 30° off-axis response. This correlates with the room's ambient energy.



THIEL CS3.7