Vandersteen Audio

Thirty years of Engineering Leadership—

For more than 30 years a dedicated team of experienced craftsmen and technicians has supported chief designer Richard Vandersteen in creating some of the most advanced concepts used throughout the audio industry today.

Vandersteen has always been a leader in the development of crossover components including premium capacitors, hand-wound inductors, high-quality circuit boards and internal hook-up wire. Vandersteen was among the first to offer floor spikes and the provision to accurately adjust the height of the listening window.

Vandersteen pioneered the use of FFT computer analysis for the design and quality control of time- and phase-accurate loudspeaker systems with the acquisition of the General Radio 2512 in 1979.

Vandersteen delivered the first full-range, time- and phase-accurate, minimum baffle, vertical array speaker system with the introduction of the original Vandersteen Model 2 loudspeakers in the mid 1970s. Narrow speakers with vertically arrayed drivers are ubiquitous today demonstrating that the Vandersteen Model 2 was perhaps the most influential speaker design in the last 50 years.

The late 1970s saw the introduction of the Active Acoustic Coupler™ bass system unique to Vandersteen Model 2 and Model 3 series speaker systems.

Vandersteen pioneered the concept of bi-wiring in 1981.

In 1982 the Vandersteen 2W subwoofer introduced the concept of Aperiodic™ operation within the bass range and passive high-pass, Feed-Forward™ bass integration unique to Vandersteen stand-alone subwoofers and Vandersteen Quatro and Models 5 and 7 series full-range loudspeakers. High current, Class B bass amplifiers with Feed-Forward™ error correction were also introduced at this time.

In the mid 1980s Vandersteen introduced a true, Push-Pull™, dual-motor, subwoofer driver. A poly-cone version of this driver appeared in the Vandersteen Model 4 loudspeakers and a single voice coil former, alloy diaphragm version of this unique driver is currently used in the Vandersteen Model 5 and Model 7 series loudspeakers.

Vandersteen introduced superior terminal strip input connectors in 1986.

In 1989 Vandersteen designed and patented a unique midrange driver with a Reflection-Free™ zone behind the diaphragm, enabled by the use of an aerodynamic chassis and small-diameter Alnico magnet system. This midrange driver was unique to Vandersteen speakers for 20 years because of design patents.

In 1997 the Vandersteen 2Wq subwoofer added Adjustable"Q"™ control to allow users to tailor bass response and character to the environment and listener taste.

In 1997 Vandersteen introduced Battery-Biased™ film capacitors in internal and external passive high-pass filters. This concept is currently used in the Model 5 and Model 7 loudspeakers.

The Vandersteen Model 5 loudspeakers saw the introduction of multi-band bass equalization, which, along with Adjustable"Q"™ and level, allowed bass response to be perfectly tailored to a variety of speaker positions in a variety of rooms. Vandersteen bass EQ is unique because there is no processing in the signal path above bass frequencies and no digital processing. This concept is currently used in the Vandersteen Quatro and Models 5 and 7 series loudspeakers.

The Vandersteen Model 5 loudspeakers saw the introduction of a unique, constrained-layer damped enclosure material that is virtually resonance free. This concept is currently used in the Vandersteen Quatro and Models 5 and 7 series loudspeakers.

The Vandersteen Model 5 loudspeakers saw the introduction of a unique molded, epoxy composite material used for baffles and plinths. This concept is currently used in the Vandersteen Quatro and Models 5 and 7 series loudspeakers.

In 2009 Vandersteen developed Perfect-Piston™ driver diaphragms hand-made from a unique, balsa-cored carbon fiber material. In addition to the elimination of cone-breakup distortion, Perfect-Piston™ diaphragms allow all frequencies above the bass range to be reproduced by the same diaphragm material for the ultimate in homogenous integration. This concept is currently used in the Vandersteen Model 7 loudspeakers.

In 2009 Vandersteen developed Carbon-Clad™ enclosure panels made from a sandwich of carbon fiber, wood fiber and elastomeric materials, bonded together in a proprietary process. This unique material allows Vandersteen to deliver one of the world's most rigid and silent loudspeaker enclosures in an affordable product. This concept is currently used in the Vandersteen Model 7 loudspeakers.

Vandersteen Model 7 Loudspeakers

Vandersteen Audio www.vandersteen.com

The Model 7 Loudspeakers
represent the zenith of Vandersteen's
balanced design approach,
which considers <u>all</u> performance parameters
including value.
Owners are assured that all Vandersteen speakers provide
exemplary performance for the price, in <u>all</u> areas, not just one or two.

Vandersteen Model 7 Loudspeakers...
create a more satisfying listening experience
by incorporating today's most advanced technologies
including unique features only Vandersteen can offer
Perfect Piston™ Drivers—Transient-Perfect™ Crossovers— Stealth™ Enclosures—Fusion™ Powered Subwoofers

Perfect Piston™ Drivers

•Perfect Piston™ drivers assure that all electronic signals appearing at the voice coils are accurately converted into sound by the driver diaphragms for the lowest distortion.

•Perfect Piston™ drivers allow all direct radiating drive elements in the Vandersteen Model 7 speakers to be made from the same material for the most homogenous sound.

•Perfect Piston™ drivers allow all drive elements in the Vandersteen Model 7 speakers to conform to the design principles of the patented Vandersteen Aerodynamic™ midrange driver to eliminate time-smear caused by chassis reflections.

•Perfect Piston™ driver diaphragms are hand-made in Hanford California of a unique, 3-layer carbon-balsa-carbon material in a Sound-Truss (patent pending) configuration. This diaphragm material has the highest stiffness-to-weight ratio currently available making it possible for Vandersteen Model 7 speakers to deliver the closest approximation of the live musical experience.

Why Perfect Piston™ Drivers?

A coil of wire moving within a powerful magnetic field can easily and accurately convert electrical signals into mechanical motion or convert mechanical motion into electrical signals. This process is called transduction and a device such as a moving coil phono cartridge or a loudspeaker voice coil is called a transducer.

A phono cartridge can convert wiggles in a record groove as small as a few wavelengths of light into electrical signals, and a voice coil can convert even the subtlest nuance of a recorded signal into mechanical motion.

With proper design a loudspeaker voice coil can be made to precisely follow the electrical signal from your amplifier. But before that voice coil motion can become sound, air pressure must be modulated and that requires a diaphragm like the dome on a tweeter or the cone in drivers designed to reproduce lower frequencies. The voice coil responds to the electrical signal from the amplifier and the diaphragm, which is attached to the voice coil, moves air to make sound. The diaphragm must be light so little energy is wasted and it must be stiff so that the entire surface moves exactly in sync with the voice coil. And therein lies the problem.

At some frequency conventional diaphragms start to flex and some portions may no longer be moving in sync with the voice coil, as they should. The frequency where this flexing starts is commonly called the first breakup mode and frequencies above this point may no longer be precisely related to voice coil movement. A wide range of diaphragm materials has been tried in order to minimize this problem with varying results.

Speaker diaphragms have been made from natural materials like paper pulp and wood pulp; from metals like aluminum, magnesium and titanium; from plastics and plastic blends like polypropylene and polystyrene; from woven materials like Kevlar® and carbon fiber; and from exotic materials like beryllium and even diamond. All have advantages and disadvantages and all have a characteristic acoustic signature.

Vandersteen has revolutionized loudspeaker design by combining structural engineering and material technology to create diaphragms that act as perfect pistons throughout their operating ranges and beyond. The unique diaphragm material used to make Vandersteen Perfect Piston™ Drivers marries carbon fiber and balsa wood in a unique 3-layer configuration with the highest stiffness-to-weight ratio available and allows all direct-radiating drivers to utilize diaphragms made from the same materials.

Transient-Perfect™ Crossovers

•Like all Vandersteen speakers, the Model 7 uses transient-perfect dividing networks for superior sound. First-order (6dB/octave) acoustic attenuation slopes are the result of compensated crossover+driver design not simply first-order filters.

•Only properly designed, impedance compensated first-order (6dB/octave) crossover+driver networks can be utilized in loudspeakers that can deliver flat amplitude response along with flat time, phase and power response.

•Vandersteen crossovers feature the finest available capacitors hand-selected for each specific purpose, along with hand-wound inductors.

•Vandersteen's time- and phase-accurate, first-order speakers provide dramatically better transient response, timbrel accuracy and imaging.

Why Transient-Perfect™ Crossovers?

A loudspeaker drive element, even those of the highest quality, can only provide optimum performance over a limited range of frequencies. Low frequency drivers must be large and powerful, high frequency drivers must be small and fast, and drivers optimized for middle frequencies must be capable of delivering articulate and uncolored midrange frequencies with low distortion and wide dispersion.

Several drivers are necessary in order to cover the entire frequency range that a full-range speaker is expected to reproduce.

An electrical dividing network, commonly called a crossover, is used to separate the frequency spectrum into appropriate sections so that each drive element is presented only those frequencies that can be optimally reproduced. Crossovers are commonly designed to blend the outputs from all drive elements to provide the flattest frequency response. Unfortunately, the reactive components used to create conventional crossover networks cause frequency-dependant phase shift. Crossovers with steeper rates of attenuation, like 12dB/octave, 18dB/octave, and 24dB/octave, utilize increasingly more reactive components, store and release increasingly more energy, and produce increasingly more phase shift. Because crossover-induced phase shift is frequency dependant it cannot be compensated for by simply staggering drive elements.

The impedance-compensated dividing networks in all Vandersteen speakers work with individual driver characteristics to produce first-order (6dB/octave) acoustic attenuation. Only properly designed, impedance compensated first-order (6dB/octave) crossover+driver networks can be utilized in loudspeakers that can deliver flat amplitude response along with flat time, phase and power response. Drivers must be physically offset (staggered) to compensate for rise time differences but the resulting outputs can be made to blend perfectly.

First-order slopes create some substantial compromises in 2-way speaker designs. First-order 3-way designs perform better with reduced intermodulation distortion. Vandersteen's 4-way designs, utilizing broad-bandwidth drivers and active subwoofers, eliminate virtually all first-order compromises.

Vandersteen's time- and phase-accurate, first-order speakers provide dramatically better transient response, timbrel accuracy and imaging.

Stealth™, Minimum-Diffraction Enclosures

•Like all Vandersteen speakers, the Model 7 has a virtually baffleless, virtually non-resonant, minimum-diffraction enclosure for more natural, open sound.

•Like the Vandersteen Quatro and Model 5a, structural panels in the Model 7 are made from constrained-layer-damped non-resonant materials and a unique molded, epoxy composite material is used for driver baffles and plinths.

• Unique to the Vandersteen Model 7 is a proprietary carbon cladding on both interior and exterior enclosure surfaces creating a unified structure that is virtually inert and resonance-free. An aerospace supplier using a very large, high-pressure, high-temperature autoclave applies the carbon layup.

•Vandersteen's Stealth™ enclosures enable superior sound and are compact and visually unobtrusive.

Why Stealth™ Enclosures?

The job of a loudspeaker is to convert the electrical signal from the amplifier into sound—not to create sound. The signal at the input to the loudspeaker is the electronic equivalent of the recording, plus any noise and/or distortion added by your other components. Sounds that originate in the loudspeaker are a distortion of the recorded signal.

Loudspeaker distortion is measured like any other distortion: the signal at the output is compared to the signal at the input and deviations are defined as distortion and expressed as a percentage of total output. Deviations (distortion) can be the result of errors caused by driver or crossover faults or they can be the result of inadequacies in the speaker enclosure like structural resonances, baffle reflections and edge diffraction.

The structure or body of a musical instrument, like a piano, violin or guitar, is designed to add rich and pleasing resonances to the sound of the strings. Any sound created by the structure of a loudspeaker is distortion so all resonances should be eliminated. Vandersteen Stealth™ enclosures eliminate these distortions by virtually eliminating resonances, minimizing baffle dimensions and covering the remaining surfaces with non-reflective materials, and carefully contouring all edges. Vandersteen speaker enclosures are acoustically inert. All structural panels are made from proprietary constrained-layer-damped materials and heavily braced. Vandersteen Model 7 speakers have additional carbon fiber layers applied inside and out with a high-pressure, high-temperature autoclave.

The body of a musical instrument is often used to focus or amplify the sound of the instrument. The enclosure of a loudspeaker is used to position the drive elements that reproduce a recorded signal. The speaker enclosure should not add to or subtract from the sound produced by the drive elements in any way. Reflections from large baffles create a delayed echo of the signal from the drive elements, blurring the sound and announcing that a large loudspeaker is the source of that sound. All Vandersteen speakers have the smallest possible baffles. Reducing the size of all baffles results in the most open and detailed sound. A unique molded, epoxy composite material is used for driver baffles and plinths, increasing rigidity and further reducing the possibility of resonance.

Baffle edges cause diffraction of the sound waves resulting in a delayed echo (re-radiation) of the signal from the drive elements. This echo is smeared over time because of varying path lengths from the drivers to the various edges and then to the listener(s). Vandersteen's minimum diffraction enclosures feature extensive attention to distortions caused by edge diffraction. All baffle edges are close to drive elements to minimize delay and carefully contoured to randomize edge diffraction. The baffle surfaces that remain are covered with a proprietary felt-like material to minimize reflections.

Fusion™ Powered Subwoofers

•Vandersteen's powered subwoofers feature unique passive high-pass integration for a seamless blend of bass frequencies with the rest of the spectrum and reduced distortion in the midrange.

•They maintain time- and phase-accuracy while extending bass response for precise reproduction of rhythm and pace and perfect fusion of harmonic overtones with fundamentals.

•Vandersteen's subwoofers feature a completely-integrated system of driver, error correction and amplifier designed to work in concert to deliver the deep, tight bass that only an equalized, active system can provide and they include other unique features like the following:

•Aperiodic design eliminates resonance and impedance variations within the pass band.

•Feed-Forward error correction for high-definition and low distortion.

•Unique dual-motor, push-pull drive element cancels mechanical distortion.

•Ultra-high-current 400watt amplifier with power-factor-corrected, regulated power supply.

•Eleven-band equalization plus master level control and adjustable "Q."

Why Fusion™ Subwoofers?

The subwoofers built-in to Vandersteen Model 7 loudspeakers are unlike anything else on the market. They don't simply "augment" bass. They extend the low frequency response of the speakers while reducing distortion in the midrange. Bass response and harmonic response are fused together in a seamless blend maintaining full-range amplitude linearity and time- and phase-response.

Passive high-pass integration reduces midrange intermodulation distortion in the speakers and main amplifier(s), maintains time- and phase-integrity, and allows the character of the main amplifier(s) to be reproduced by the bass amplifiers.

The unique Vandersteen drive elements are capable of extreme linear travel. These elements are driven by ultra-high-current amplifiers to deliver bass with high impact, low distortion, and high definition unmatched by rivals.

A subwoofer enclosure is integral with each speaker and has no ports, produces no resonance or group delay allowing fast response and precise reproduction of rhythm and pace for the perfect fusion of harmonic overtones with fundamentals.

Eleven-band equalization plus master level control and adjustable "Q" allows versatility of placement. The speakers can be positioned for best imaging and/or esthetics and the bass can be adjusted for best sound. The bass response can also be tailored to the individual taste of the listener(s).