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Vandersteen Audio, Inc. Factory Tour

Digital photography and text by Doug Blackburn

Introduction

Vandersteen Audio has been making loudspeakers in Hanford, CA for 20 years. Hanford is in central California roughly halfway between San Francisco and Los Angeles. Surrounded by the San Joaquin Valley, Hanford is a reminder of what California might have been like in the 1960s. The Vandersteen factory is located just a block north of the main east-west highway through town. I-5, the main California north-south route, is 30 miles to the west, and the Sierra Nevada Mountains are 40 miles east with snow-covered peaks on the horizon all year.

Photographing the factory building itself proved problematic -- the front facade is completely covered by well-manicured trees and shrubs planted at the edge of the sidewalk. The building is situated right at the edge of the sidewalk. It is a clean, well-kept building, about what you would expect for a well-maintained small manufacturing building that is perhaps 15 to 20 years old. In keeping with Richard Vandersteen's low-profile way of doing business, the Vandersteen Audio factory doesn't have a "Vandersteen Audio" sign on the building, and the mailbox contains only the street address.

Size-wise, the factory was pretty close to what I expected, not too large, not too small. The building spans the width of a block, putting the front door on 4th Street and the loading/shipping dock on 5th Street.

Richard Vandersteen is the founder and chief designer of Vandersteen Audio. The current Vandersteen product lineup includes speakers for audio and home-theater use. They are the Model 1C ($715/pr, optional bases $85/pr), Model 2Ce ($1295/pr, optional bases $125/pr), Model 2Ce Signature ($1495/pr, optional bases $125/pr), Model 3A ($2795/pr including large Sound Anchor braces), Model 5 ($9,800 in oak or walnut, $12,300 in rosewood; high-pass filters extra: $595/pr single ended, $795/pr balanced). Vandersteen Audio makes three powered subwoofers, the V2W, 2W and 2Wq -- all priced at $1250 each. Home-theater speakers are the VCC center-channel ($495), VCC Signature center-channel ($1095, offers enhanced performance to better match Model 5 or 3A speakers), and the VSM wall-mounted rear-channel ($795/pr including mounting hardware).

Production at Vandersteen Audio is done in batches. On this trip I didn't see any Model 3A,

VCC, VSM, or 2W series loudspeakers in production. But there were plenty of 1Cs, 2Ces and Model 5s being made. The Model 5 loudspeaker seems to be an instant success. Even though the company is building Model 5s as fast as they can, there has been a 90-day backorder situation for over a year -- quite surprising for a five-figure product.

Anyone who has cut MDF or particle board with a power saw knows how much of a problem the dust is. Loudspeaker factories are cutting and sanding MDF all day, every day, and you can imagine the amount of dust created. It's everywhere. Efforts are made to vacuum dust away from machine tools while they are in operation, but there is always some that escapes. The offices, crossover fabrication areas and driver test areas are relatively free of dust. Driver assembly and final testing are done well away from areas which generate MDF dust. What was probably the most remarkable thing was how little build-up of dust there was in corners, etc. It takes some serious and regular cleaning to keep a place that turns this much MDF into products every day from becoming buried in dust.

On with the tour!

Jaclyn at her station (shown right) -- the Vandersteen Audio reception area. The view out the window is onto 4th Street.

Shown in the photograph below left is the driver test area. Nevin has a midrange driver loaded in a sealed box in front of him. You can see the unusual shape of the unique Vandersteen midrange driver which has a very slender and aerodynamic shape to the magnet structure and basket to minimize reflections of back-wave energy back onto the cone. The sealed box contains a microphone that is connected to the computer. A tone generator creates a frequency sweep that is picked up by the microphone inside the box that the driver is firing towards. The computer plots what the microphone hears. Drivers are then sorted into matched pairs and assigned code numbers. If a driver in a Vandersteen loudspeaker ever fails, it can be replaced by a driver which matches the original driver.

To the right of the console Nevin is seated at is a smaller beige box which is used to integrate all the Model 5 drivers (tweeter, midrange and woofer) with the crossover as a complete perfectly matched set. This is also a sealed box containing a microphone. The blue rack further to the right contains many midrange drivers which have been measured and assigned their "match numbers." Additional fixtures not shown in this photo are used for other types of driver and crossover testing and matching.

At another station on another day, Nevin winds by hand air core inductors used in Model 5 crossovers (shown in photograph left). Even the Model 1C and 2Ce get hand-wound air core inductors made right at the Vandersteen Audio factory for their crossovers (shown below right).

Huge sheets of MDF arrive at the "back" of the plant. Their first stop is this impressively large machine which cuts the very heavy large sheets into slabs of manageable size. They are then turned into multiple parts on saws and routers elsewhere in the factory.

In the photograph below left, a numerical control router turns one of the cut-down slabs of MDF into multiple individual enclosure parts.

Model 5 "head" assemblies (below right) after being glued up from 20 separate pieces of MDF, each with differently shaped holes for the tweeter, midrange and woofer transmission-line cavities. The rear-most head assembly in this group has had the front surface milled, notable by the shaping of the surfaces around the tweeter, midrange and woofer openings.

This operator (right) is putting an angled surface on one side of the head module for a Model 5 loudspeaker. The router rests on an angled steel plate which has holes in it that control where the router is allowed to remove material. The Model 5 head is locked in place below the router and guide fixture.

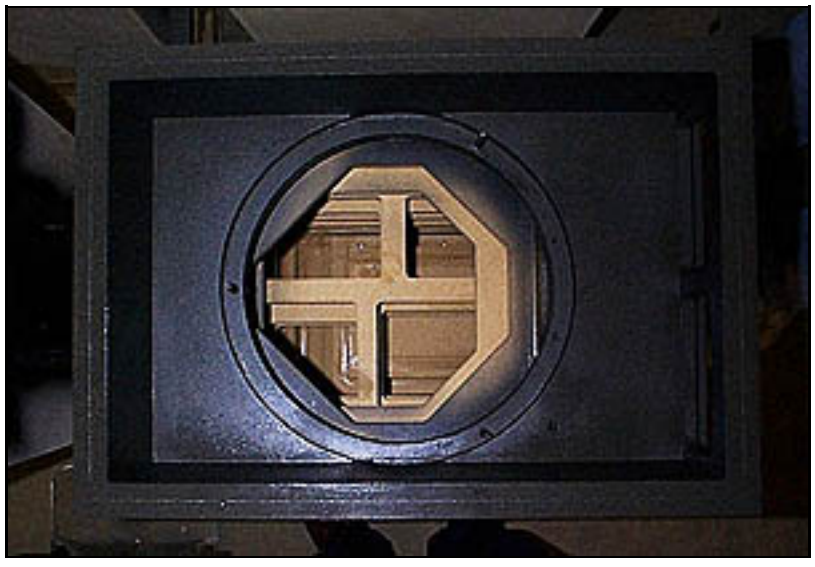
In the paint booth (below left), the head of the Model 5 is painted with white primer. This coat is sanded to fill small holes. After the head is completely smooth, a final white primer coat is applied. The technician here is applying dark orange filler to obvious low spots before sanding. The Model 5 head will be sanded and filled several times on the way to a perfect finish -- even though it sits under the removable grille cloth. The masking paper protects the base of the model 5 cabinet from spray and dust. To the right (in the photo below left) is a large vertical light used to help find surface imperfections during the finishing of the Model 5 head.

"Perfect" Model 5 heads in primer (below right) line up waiting to be moved to the next station. Ultimately, the heads will receive a final coat of semi-gloss black paint.)

In this close-up shot (right) you can see how each MDF lamination in the Model 5 head has a different shape inside. You are looking at the midrange (upper) and woofer (lower) transmission lines. The different-shaped holes in the layers of MDF that makes up the head create a labyrinth transmission line which causes the back wave to reflect many more times that it would if the transmission line were smooth. Each reflection sends the back wave through the damping material again; the more times the back-wave energy is reflected though the damping material, the more energy it loses. The objective is to get as close to zero back-wave energy reflecting back onto the speaker cone as possible. Any energy which does reach the back of the speaker cone results in 100% distortion, something that should be avoided at all costs. The transmission lines intentionally do not follow straight lines. This improves their effectiveness for damping the back wave. The midrange transmission line curves upwards at the rear using otherwise unused space behind the tweeter's shallow transmission line. This further lengthens the transmission line -- longer is better for damping the back wave. The woofer transmission line goes up and down and changes cross-section area a couple of times before it too rises at the back.

At the driver installation station, the technician is installing damping material in the subwoofer enclosure of a Model 5 loudspeaker. The Model 5 uses a unique single driver with two magnets, two voice coils, and two cones facing each other. This creates a true push-pull subwoofer driver -- it is driven in both directions. In the Model 5, the subwoofer is downward firing, so the damping material has to be loaded through the bottom of the speaker.

Looking straight down (photo below) into the bottom of a Model 5 loudspeaker, you see the mounting hole for the subwoofer, and inside that the irregularly spaced asymmetrical braces which are part of the back-wave attenuation scheme. Damping material fills most of this chamber when the speaker is completed. Vandersteen Audio uses box-inside-a-box construction for the subwoofer enclosure to virtually eliminate cabinet resonances. Prototypes using other construction methods produced what Richard Vandersteen thought were unacceptable levels of cabinet resonance for his flagship product.



(Looking into the Model 5)

Shown below left, the Model 5 loudspeaker is bolted to the bottom of the shipping container. Model 5 loudspeakers are shipped bolted to a wooden pallet to help avoid shipping damage. The head has received the black paint, and the small baffle area around the drivers is covered with acoustic felt to further reduce cabinet diffraction.

Below right, a packed Model 5 on its pallet (rear) waits for its partner. From the rear of the Model 5 (right photo below) you can see the subwoofer port at the bottom, the 400W subwoofer amplifier's heat sinks above the subwoofer port, and speaker-cable connections above the heat sink.

In the driver installation area, several rows of finished 2Ce cabinets are stacked awaiting installation of drivers. The small stool between the rows of 2Ce cabinets is a dolly to roll speakers around on during the driver-installation process. You can see some of the construction features of the 2Ce cabinet, where you see the front view. The four vertical dowels space the grille cloth out away from the speaker cabinet. Each driver is recessed to physically align the acoustic centers of the drivers. Finally, each driver has an enclosure that is separate from each of the other drivers. In the center of this photo are stacked pairs of 2Ce

cabinets in which the drivers and crossovers have been installed. These assembled speakers are stacked with their backs facing the camera. You can see the low-mounted 10" rear-firing bass coupler. This is a driver with a magnet and voice coil used in the same way you would use a passive radiator. However, because it is driven, it is an active device. Its purpose is to extend the bass response and improve bass quality. The 10" bass coupler does produce bass, but it also significantly helps the 8" front-firing woofer's performance. The racks to the right contain matched drivers and crossovers to be installed in the empty 2Ce cabinets.

Assembled 1C (shorter) and 2Ce (taller) speakers make their way along a conveyor to the final test area. There are over 100 finished loudspeakers in this photo. In this case "finished" does not mean "complete." Speakers are tested before the grille cloth and top and bottom caps are installed to ensure that everything is perfect before buttoning up the speakers for shipment.

A technician moves a Model 1C loudspeaker into position for final testing (shown below left). The wall to the right has a hole which opens into a large, highly damped chamber that contains a microphone. The speaker is connected to a tone generator, and a computer analyzes the response of the loudspeaker via the microphone in the chamber. Any response problems are corrected before installation of the "cosmetics."

Finish sanding is in progress for what will be a top cap (below right). This trim piece dresses up the appearance of the loudspeaker. The top caps, bottom caps and grille cloth are installed just prior to shipping the loudspeakers.

In this final shot, you can see some of the Model 5, 2Ce and 1C loudspeakers that are fully prepped for shipment and waiting to be picked up. The products you see here are only a portion of the day's outgoing shipment.

The loading dock is one block from the reception area -- the depth spanned by the factory.

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To find out more about Vandersteen Audio, visit their website at www.vandersteen.com.