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CERWIN-VEGA STROKER PRO 15

TEXT: VANCE DICKASON & ERIC HOLDAWAY
PHOTOS: COURTESY OF MANUFACTURER

MORE THAN A ONE NOTE WONDER — A FRONT-RUNNER FOR SOUND QUALITY *AND* SPL

Since 1954, Cerwin Vega, one of the oldest speaker companies around, has had a major reputation for building speakers that allowed everyone to be "loud and proud." Therefore, it's no surprise that Cerwin-Vega has introduced one of the most outrageous car subwoofers I have reviewed to date, the Stroker Pro 15. At 68.3 lbs., they have the "Where's the Beef?" award in the bag. Even more impressive than its physical size is this product's technology.

The Stroker Pro cast aluminum frame acts as both a giant heatsink (an old but good trick) and a highly effective Faraday shield or shorting ring (a new patent-pending trick). The cutaway drawing (Fig. 1) shows that this woofer not only has two separate magnets (actually, the lower magnet is two magnets stacked together, so technically three magnets), but also two gaps, a technology known as Multiple Magnet Air Gap (MMAG). Because of the physical layout of the MMAG motor format, CV could mount the lower magnet system to the back of the frame, like a normal woofer, but turn the frame's inside diameter upward to form a shorting ring.

In addition to attenuating nasty eddy currents produced by the woofer motor and lowering distortion, a large shorting ring also reduces motor temperature by decreasing inductive heating. Figure 2 reveals what an outstanding thermal pathway this frame makes with the upturned section directly adjacent to the naked voice coil. The Stroker has four other thermal pathways: two in the spider-mounting area and two at the rear of the motor. There are two sets of vents integrated into the lower-spider mounting shelf (this woofer has two mounting shelves for three spiders). A 1/8" gap goes around nearly the entire perimeter of the

Figure 1

shelf's 10 1/4" diameter except for the six 1/2"-diameter mounting posts that it suspends from. This gives substantial venting area for the airflow generated by the lower spider motion to move air past the exposed voice coil and top plate. For the air caught between the two spiders, there are an additional six 1/4" x 2" vents. At the back side of the motor you have a series of six 3/32" diameter peripheral vents that move air from between the pole piece and the voice coil out the back of the T-yoke. Lastly, an aluminum-sleeved 1 3/4" diameter pole vent powered by the large, moving clear plastic dustcap supports the third spider at the top of the woofer. Because of this, the sleeve extends to about double the height of the pole, and thus acts as another heatsink.

The real heart is the MMAG motor structure. Since the voice coil is shorter than the combined length of the two gaps, it appears similar to a conventional underhung voice coil motor. In the conventional motor, as the short coil rides out of a single large gap in either direction, the total number of voice coil turns in the gap decreases and so does the total Bl, or total horsepower, of the motor. However with the Stroker Pro dual-gap motor, the situation is more like having two gaps working in unison. As the number of turns starts decreasing in one gap, the number of turns in the other gap increases so that the number of voice coil turns of wire in the gap stays constant. The cool part is that it operates in a way that the two gaps are always working in conjunction with each other such that the number of turns does not begin decreasing until the voice coil starts to leave just one gap. (See sidebar on pg. 73 for more information on dual-gap technology.)

Other features for the Stroker Pro motor include a forged and CNC-milled single piece T-yoke that includes an extended pole piece with a pole vent. This vent gives access to a patented adjustable spider bias system for the top or third spider. All the original Stroker woofers had this adjustment system; however, it was set at the factory for maximum linearity. Stroker owners found that tweaking this setting enabled the woofers to play even louder. Biasing a spider toward the front side and causing the voice coil to be deliberately off-centered toward the front of the gap area creates higher amounts of even-ordered distortion (2nd and 4th harmonics to be exact). Besides the warm tones caused by the biased spider, the increased even-order distortion also increases the bass due to a psycho-acoustic phenomenon called the missing fundamental (which produces perception of low bass from notes an octave higher). So, if you want to go from very clean linear bass to an altered warm bass sound quality, Stroker Pro woofers come with a tool that allows the user to do that.

One of the key features to good subwoofer performance is a solidly stiff cone, and the cone in the Stroker is about as stiff as it gets. Built from layered carbon graphite and thick paper, the cone is further reinforced by the large 7 1/2"-diameter clear polycarbonate dustcap. Long excursion in a subwoofer requires the suspension to move long distances. One solution is incorporating a wide surround that allows the cone to move further. However, this decreases the cone area, which in turn requires the cone to move further! Cerwin-Vega's patent-pending solution is SdMaxx (Sd is an engineering abbreviation for the area of a cone). Rather than being low and wide, the polyether foam surround is more of an ellipsoid shape, tall and narrower. The result is the same excursion ability, but a greater cone diameter and area. The other part of the SdMaxx system is an attachment design that allows the entire cone

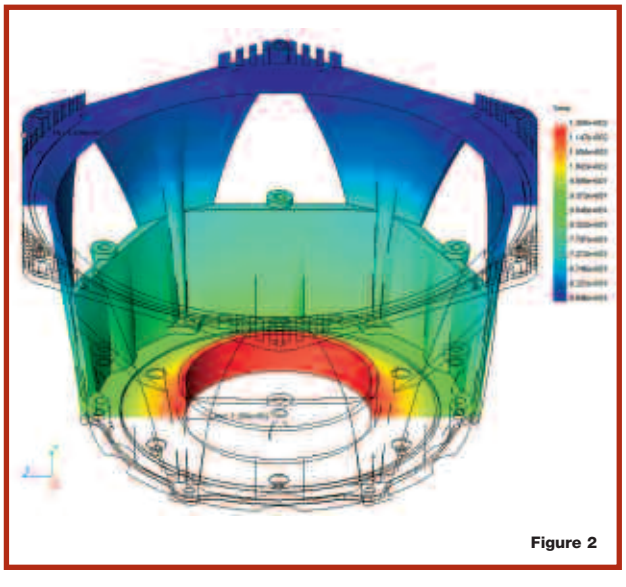

Figure 2

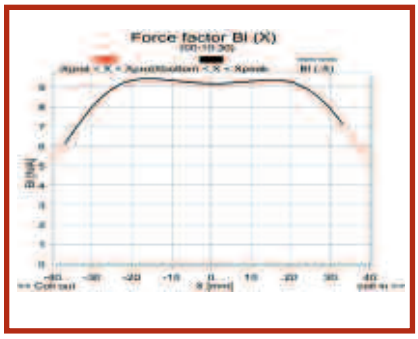

Figure 3

assembly to be quickly removed and replaced.

The rest of the assembly consists of the three-polycotton/conex blend spiders. The two lower spiders (mounted inverted to each other to cancel out some of the non-linear behavior) are 8 1/2" in diameter while the top spider is about 7" in diameter. All three are progressive, which means they increase in stiffness the further out they move in either direction. The dual four-layer voice coil is wound with high-temperature copper wire on a black anodized 100mm (3.9") diameter aluminum former. Voice coil tinsel leads are connected to dual connecting blocks on opposite sides of the frame. Each terminal block has two sets of hex screw terminals that accept up to 14-gauge wire, allowing the Stroker Pro to be easily configured with the voice coils in series or in parallel.

IN THE LAB

Part 1 of the objective measurement consists of large signal analysis followed by the LEAP 5 analysis. Using the Klippel analyzer (on loan from Klippel GmbH), Pat Turnmire, *CA&E* reviewer and CEO of Redrock Acoustics, performed the large signal analysis and provided the Bl (X) curve shown in Figure 3. The black curve is the Bl curve and shows the motor strength of the woofer as it moves in both directions from center rest position. The lighter curve is a type of displacement curve, and if both curves were identical, the motor system's motion in and out of the frame would be perfectly symmetrical. When a woofer is totally linear (linear would mean that the woofer motion matches the input signal exactly with no distortion), the Bl curve should be centered on the 0mm point (where the cone is positioned when there is no signal) and symmetrically decrease with the same slopes in both directions of voice coil travel. When a woofer exhibits a forward or rearward offset it may indicate the magnetic and mechanical systems are not absolutely optimal. If the motor strength decreases more rapidly in one direction (usually the outward direction) than the other, the result is increased levels of distortion at high operating levels. It is not uncommon, however, for a woofer voice coil to be deliberately offset a few millimeters in order to keep the motor more linear in the 90-110dB SPL range, which exactly describes the situation with the Stroker Pro.

The Stroker Pro Bl (X) curve shows the woofer voice coil is offset by a fairly trivial 2.5mm rearward (inward) from its rest position. This Bl curve is a very symmetrical, broad and flat plateau with nearly equal slopes in either direction. The displacement at operating SPL near Xmax is nearly 0mm, so this is about as good as it gets. Bl can decrease to approximately 70% of its small signal value and the driver will still function in a satisfactory manner, only with an elevated level of distortion (about 20%). Since this is not really perceivable, it's really not a subjective problem. The 70% of maximum Bl displacement limit for the Stroker Pro is 36.3mm, 4.8mm more than the physical Xmax of 32mm.

This subwoofer's Kms(x) or Stiffness of Suspension curve (see Fig. 4) likewise exhibits very good symmetry in both directions of travel. The offset is a negligible 0.5mm rearward at the rest position and transitions to about 2mm of also not-so-significant forward offset as it reaches the physical Xmax of the woofer. The compliance limit for the suspension when it drops to 50% of its rest value is greater than 38.1mm. Both "limit" numbers, Bl and compliance, represent the level at which distortion climbs to 20%, which is a realistic criteria for subwoofers given the ear's lack of sensitivity to distortion at low frequencies.

Next I generated the T/S (Thiele/Small) parameters for the Stroker subwoofer. Following my usual speaker geek test procedures, I used a LinearX LMS (Loudspeaker Measurement System) analyzer and VIBox for measuring dynamic impedance (impedance at different voltages). Testing is accomplished by performing a series of voltage and current sweeps that are later converted to multiple voltage impedance curves. With the driver clamped to a rigid test stand, measurements were made at

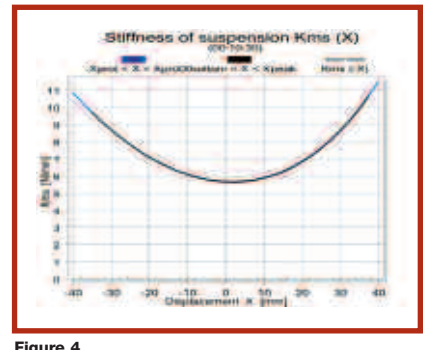

Figure 4

1V, 3V, 6V, 10V, 15V, 20V, 30V and 40V. Rather than use an added mass or test box method to find the Vas (volume of air equal to the driver compliance) of this driver, the measured weight of the cone body (with 50% of the surround and 50% of the three spiders removed) was used instead. This group of multi-voltage impedance curves was copied into the LEAP 5 software and the parameter model derivation utility was used to produce the T/S parameters shown in the data chart. These numbers were then used to generate the computer box simulation data provided in the Data Chart.

The Stroker Pro Thiele/Small parameters shown in the Data Chart were used to produce computer box simulations using the Leap 5 Enclosure Shop software. The software was configured to simulate the woofer's low-frequency performance in the same size boxes recommended in the Stroker Pro manual, a 2.7ft³ sealed box with no fill material and a 3.0ft³ ported box tuned to 36Hz with two 4" diameter vents and also with no fill material. The LEAP 5 graph curves in Figure 3 show the SPL at 2.83 volts (black curves) in half-space, 2.83 volts in an average 154ft³ car compartment (blue curves), and at the SPL at a power level required to get maximum linear excursion (red curves, also half-space). The sealed box curves are solid lines and the ported enclosure curves are the dashed curves. The 2.83-volt results produced an F3 of 43Hz for both box types. Increasing the simulated input voltage for the 2.7ft³ sealed box computer simulation to 150 volts increased excursion to the Xmax +15% level and pushed the SPL to a seriously devastating 126dB. The 3.0ft³ vented box computer simulation took 126 simulated volts to drive the Stroker Pro to just beyond Xmax (Xmax + 15% or 36.8mm for the 15" Stroker woofer) and resulted in an SPL of an extremely loud 128dB! This monster definitely

DATA CHART

Brand: Cerwin-Vega
Model: Stroker Pro 15
MSRP: $1,699.00
Warranty: 1 year parts and labor

MECHANICAL SPECIFICATIONS

Weight	68.3 lbs.
Rear Mounting Clearance	9.75"
Woofer Magnet Dim. (dia. X ht. in mm)	260 x 20 x 2, 200 x 20
Voice Coil Diameter	100mm (3.93")
Voice Coil Winding Layers	2x2 (two, two-layer coils)

MEASURED T/S PARAMETERS

Nominal Impedance (ohms)	4
Revc (ohms)	3.65 (both 1.83-ohm voice coils connected in series)
Sd (cone area in square meters)	0.087
Bl (motor strength in Tesla Meters)	22.2
Vas (in liters):	40.0
Cms (micrometers per Newton):	37.4
Mms (grams):	468.1
Fs (Hz):	38.7
Qms:	4.47
Qes:	0.83
Qts:	0.70

POWER AND EXCURSION DATA

Sensitivity (2.83V/1M in dB):	86.1 series/92.1 parallel
Continuous Power Handling (watts RMS):	2,500
Peak Power Handling (watts):	5,000
Xmax ([coil length – gap height]/2 in mm):	38.6

COMPUTER SIMULATION DATA

Enclosure size for simulation (cubic feet)

Sealed:	2.7 (0% fill)
Vented:	3.0 (0% fill) tuned to 36Kz

-3dB (F3) at 2.83V

Sealed: (Qtc=0.93):	43.0Hz
Vented: (Qtc=0.93):	43.0Hz

Voltage to achieve Xmax + 15%

Sealed:	150V
Vented:	126V

SPL at Xmax + 15%: (36.8mm)

Sealed:	126dB
Vented:	128dB

CERWIN-VEGA STROKER PRO 15

needs to be treated with respect.

The Stroker Pro is an amazing exercise in maximum potential, and while I don't think this is everyman's subwoofer, for those who want to join the Cerwin-Vega "loud and proud" tradition, it's a very serious piece of equipment. The engineering integrity of the product is impressive and it has the features required for producing extreme SPL in a car (something to be very careful with if you value your hearing). Given the ability to modify the sound quality with the spider-adjusting tool, my guess is it will come off well in the listening test. I'm as curious as everyone else to know if a woofer that measures this well sounds as good as it looks. —VD

SUBJECTIVE

The Cerwin-Vega Stroker Pro 15 arrived on my doorstep in an Anvil-type case with steel flip-up handles, just like those used to carry concert gear. Opening the box I was blown away—the subwoofer itself looks fantastic. It's tall, massive and damn near 70 lbs.! But it's the clear dust cap that captures your attention, allowing you to view the front spider and the carbon-fiber cone structure beneath. Beautiful!

Once I got the sub out of its case (with a little help), I quickly pulled out the instruction manual to see what the power handling was. I damn near fell off my stool when I read the 2,500 watts RMS power figure and the mind-bending 5,000-watt music rating! But this technological wonder doesn't come cheap. As a matter of fact, the Stroker Pro 15 is the most expensive subwoofer I have put through its paces on these pages with a staggering retail price of $1,699.00.

MUSIC SELECTION

Artist	Title	Music Type	Points Possible	Cerwin Vega Stroker Pro 15
Tracy Chapman	"Heaven's Here on Earth"	Folk/Rock	12.5	11
Diana Krall	"Love Scenes"	Jazz	12.5	10.5
10,000 Maniacs	"Peace Train"	Pop Rap	12.5	11
Usher	"Intro" & "Yeah!"	Pop Rap	12.5	10.5
Total			**50**	**43**

Ratings: **01** Poor **06** Average **12.5** Superior

INSTALLATION

A quick call to Cerwin-Vega got me to Bob Diamond, CV's senior design engineer. He recommended I use a sealed enclosure with an internal volume of 2.7ft^3 for the best overall sound quality. Jayson Olson, master installer at Speaker Works, was enlisted to build this special enclosure. The enclosure would be constructed out of two layers of 3/4" MDF with internal bracing to add strength and minimize flexing of the enclosure walls.

Connecting the wires was fairly simple. The Pro 15 uses heavy-duty metal blocks with Allen head set screws to lock the wires in. The subwoofer's dual 2-ohm voice coils were wired in parallel for a 1-ohm load.

Mounting the subwoofer into the enclosure was a bit tricky. First, you are dealing with a front panel on your enclosure that is twice your regular thickness and Cerwin-Vega supplies these threaded steel plates and cap screw bolts to hold the Stroker in. My guys predrilled the holes in the box's face and then glued the threaded steel plates into position. Remember, this is a large and heavy enclosure at an estimated 70 lbs. Combine that with the Pro 15 and we're dealing with approximately 140 lbs.

It was time to see if we could fit this behemoth into my Scorched-Earth Black Ford F-350 truck. There was no way to place it in my normal location on the floor, so we placed it carefully on the rear seat. We tried the Stroker facing up and forward, pointing left and right, but it did not sound correct. With the enclosure on the rear seat, my seating location was in a null point and the bass response was pitiful at best. If I put my head up by the steering wheel, bass level increased exponentially. I flipped the polarity of the Stroker, which did not help, so it was back to the drawing board. Our solution was to pull the rear seat out of the Ford. This would allow us to get the Stroker into the location that generally works best for most subwoofers

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in my truck. The acoustic match greatly improved and now we had a great-sounding subwoofer (what I won't do for *CA&E* magazine, jeez!).

To power the Stroker Pro 15, I installed a Zapco C2K-9.0XD amplifier to run it. The 9.0XD features a 24dB-per-octave crossover. With the 1-ohm impedance of the driver, this Zapco will deliver 2,000 watts of power. The front half of my reference speaker system consists of a pair of USD Audio B-72Pro WaveGuide separates. I power these with a Zapco C2K-6.0X amplifier at 150 watts per channel. The built-in highpass crossover filter was used to block the bass to the component system. These amps are fed via Zapco's Symbilink balanced line driver SLB-U. There are no other signal processors in the signal path.

SUBJECTIVE SCORE CHART

	Points Possible	Cerwin-Vega Stroker Pro 15
Overall Sound Quality	50	45
Tonal Balance	10	08
Low-Frequency Extension	10	09
Clarity at Low Volume	10	08
Clarity at High Volume	10	09
Impact	10	09
Total Subjective Score	**100**	**88**

Ratings: 00 Poor **05** Average **10** Superior

LISTENING

After four hours of break-in time I inserted a favorite track—Tracy Chapman's "Heaven's Here on Earth." This subwoofer goes from very low frequencies all the way up the scale smoothly without drawing attention to itself. The bass imaging was extremely good. The bass line always stayed up front and did not pull to the rear of the vehicle at any point. The bass drum was tight and the bass guitar smooth and proper. That's what's so intriguing about the Stroker Pro. There is nothing faint about the looks of this subwoofer, indicating that it could not be anything less than a brute, yet it had an articulate and delicate reproduction quality when the music called for it. And, it had no trouble replicating layered bass lines. Overall, each instrument stayed well defined and taut.

On Diana Krall's *Love Scenes* album, the standup bass note changes were clear and well defined. The note-to-note levels were equal and at no time were they out of proportion to each other. The bass plucks were very punchy and taut. This subwoofer is no one-note wonder. It accurately reproduces the frequency changes up and down the scale from the string bass to the guitar and the drum kit. It was very snappy and tight with excellent control. The Pro 15 exhibited no blooming in the upper bass frequencies like many of the other subs I have tested.

A great benefit to using a large diameter subwoofer like this one is how well it energizes the interior of your vehicle at really, really low frequencies. Case in point, I had to remove my garage door opener and sunglasses from their usual perch overhead at far lower volume levels because they were rattling almost instantly.

I played the 10,000 Maniacs remake of "Peace Train" next. It opened with a bass drum kick that was very low in frequency. Many subwoofers will do an adequate job on this passage, but the Stroker Pro 15 really got the job done. Each kick of the bass drum was sharp, solid and deep. This track illustrated the performance gains that large format subwoofers have over smaller subwoofers.

Wrapping up, I put in Usher's latest album and cranked up the "Intro" track that leads into the track "Yeah!" "Intro" uses mostly acoustic instruments with super dynamics and at 0:23 secs into it, the Stroker punched out a super tight, loud bass line that was still very realistic sounding. On "Yeah!" it simply laid down powerful, pumping bass that went down to the lowest bass notes clearly. Even on this repeating boomfest, the bass image stayed up front, solid and fixed.

CONCLUSION

The more I listen to the Cerwin-Vega Stroker Pro 15, the more I like it. It is the best all-around large-format subwoofer that I have tested by a large percentage. It did not matter what type of music I played, the Stroker Pro 15 made it sound correct and good. It does its job at all volume levels and can handle fantastically high amounts of power. This thing is very expensive, but its performance is exceptional! Looks like I am going have to do some begging to get a couple for our VW Beetle show car. Hey, Mr. Diamond! We need to talk. —EH

SPL in car measurement at 2.83 volts, 1 meter – with Bruel & Kjaer Type 2231 Level Meter set to Un-weighted, SPL and Fast.

20Hz > 90.6dB
40Hz > 93.4dB
80Hz > 94.6dB
Max SPL > 136.3dB

The Max SPL measurement was taken using only 2,000 watts. At 5,000 watts, a gain of 3-5dB is conceivable.

XMAX AND DUAL-GAP TECHNOLOGY

If you were to look at the Stroker's motor in conventional terms, and consider the distance from the outside of one gap to the outside of the other, a distance of 44mm, as one long gap and figured Xmax based on this and the voice coil length (remembering that Xmax is voice coil length minus gap height and that number divided by 2), which is 38mm for the Stroker Pro, then the Xmax would only be a silly 3mm. However, when you consider the dual 12mm gap aspect of this motor, the Xmax number is really 32mm. And if you consider the actual Bl curve of this monster, it's really more like 36.8mm, which is the manufacturer's Xmax specification for this woofer.

There are a number of positive aspects to this dual-gap technology, the biggest being the enormous excursion potential. For a given coil length, the dual gap motor will have 2.5 times more Xmax than a conventional single gap motor. For example, a 38mm voice-coil length with a single 12mm gap would have an Xmax of 14mm, compared to the 32mm of the Cerwin-Vega dual-gap woofer. The other benefit has to do with how constant Bl is at high SPL levels. Many conventional woofers have a more or less "bell" shaped Bl curve, which means that as they start operating at maximum SPL levels, the Bl or motor drive level will begin decreasing rapidly. This coupled with the elevated voice coil temperatures mean that the effective box Q and F3 numbers are generally higher than at low SPL levels. Effectively, this suggests that the really low bass tends to go away somewhat when you get extremely loud with most subs. With the Stroker Pro, the Bl curve is very flat and extended and the result is that the motor does not exhibit as much box Q and F3 shift as is normally experienced at high SPL levels. While this extra high output stability is primarily due to the flat Bl characteristics of the Stroker Pro, some of this stability can be attributed to its excellent thermal cooling characteristics.