The Small 'Classic' "Voice of the Theater" by Jim Dickinson

A 1989 paper by a theater consultant regaring auditorium use of VOTs
www.soundpractices.com

What is a "small" classic "Voice of the Theatre"? Generally these.speakers are those "Voice of the Theatres" with one woofer. Like their larger counterparts, they use a multicell or sectoral High Frequency horn driven by a theater style High Frequency driver atop a combination midbass horn/bass reflex enclosure driven by a 15" woofer. This paper covers models A5,A7,A7-500, 800, and an exception, the original dual woofer A6.

The A5

The A5 could be called the "medium""Voice of the Theatre". It uses a single woofer L.F. enclosure with-the 515 woofer, large multicell high frequency horn and the 288 high frequency driver of the A4. Recent versions are now using the mid size MR II 500 series of Mantaray constant directivity H.F. horns in place of the multicells. These speakers are used in rooms where an A4 is deemed too large and the smaller units are not adequate. Early 'A.5's used the H-110 horn/reflex L.F. enclosure. This Unit had a midrange/midbass horn of similar size to that of the 210 enclosure of the A4 driven by a single 515 woofer. When the 825 horn/reflex enclosure (used in A7, A7-500) was refined in the mid 1950s, it replaced the H-110 in the A5. The H-110 did project better than the 825, however, it was used only in the A5 and was-much larger and more expensive. The 825 was later simplified into the 828 enclosure which is currently being used. Until recently A5's used the large N-500 500hz series of crossovers. Current models use the N-1285 type crossovers. For driver evolution, consult the driver chart in the "Large V-0-T.T." writing.

The 800 System

The first of the truly "small"systems, the 800 was introduced in 1947 and discontinued in the early 1950's. It used an early version of the 825 bass enclosure driven by an 803A 15" woofer. The hiqh frequencies were produced by an H-808 2x4 cell, multicell H.F. horn driven by a "small pattern" (1" exit hole) 802B H.F. driver. The crossover was a smaller N-800 800hz unit. The H.F. horn of the 800 system was narrower in horizontal projection than the later models and possibly worked best in narrower theatres.. The 800 was replaced by the A7.

The A7

In the history of professional audio there has never been a more used and misused loudspeaker than the A7. They were used as studio monitors, High Fi speakers, P.A. speakers, and of course in theatres. These speakers are the main reason people recognize the name "Voice of the Theatre". The A7 used either the 825 or 828 bass enclosure driven by an 803, 416 or in the case of the A-7XX, a 515B woofer . The high frequencies used an 811 sectoral horn driven by an 802, 804,806, or 807 high frequency driver. The crossover was an 800 Hz N-800 or N-801 unit. The A7 was introduced in 1954 and discontinued in 1980. Early A7,s were 16.ohms impedance, and since 1969 have been 8 ohms impedance.

The A7-500

The A7-500 is an A7 with a different H.F. horn and crossover, and always uses the larger of the small pattern drivers, most notably the 802. A7-500's used 825/828 L.F. enclosures driven by an 803B or 416 woofer. The H.F. horn is the 511B driven by an 802, 808 or 902 H.F. driver. The crossover is a small N-500 or N-501 500 Hz unit.

These speakers were used in larger or more acoustically difficult venues than the A7's due to the larger H.F. horn. The A7-500 was introduced in 1957 and discontinued in 1984. The current A7-8G is basically an A7-500 using the 515-8G woofer and 902-8B driver. The crossover is the multi-frequency N-1285. Recently ALTEC has released the MR-994A constant directivity H.F. horn and higher power 909-8A H.F. driver to replace the 511B horn and 902 driver.

The Original A6

Please do not confuse this speaker with the current dual woofer vented box A-6. The early A6 was an early A7 with a second L.F

enclosure and woofer. It was introduced in 1954 and lasted only a few years. Its only claim was greater bass and midbass than an A7. These speakers were mostly used in 4 and 6 channel magnetic stereo systems; they were generally inadequate during mono use. Components used were two 825 L.F. enclosures, two 803A woofers, one 802 driver, and one N-800 800 Hz crossover.

What's So Good About A Small V-0-T.T.?

The small family of "Voice of the Theatre" speakers are the mainstay loudspeakers of the small neighborhood and shopping mall cinemas. They cost far less than the big "V.O.T.T.'s" (an A7 costs one-third that of an A-4), allowing little theatres to have good sound- Like their big brothers, these speakers are quite efficient and also have similar directional characteristics to the H.F.and L.F. sections. Both sections being horn loaded also minimizes the ballastic differences between the very light horn driver diaphragms and the relatively heavy cones of the woofer.

If not abused, these speakers are extremely reliable.

What's Wrong with a Small V.O.T.T.?

The main problem I see with the "smaller" units is one of installing them in places too large for them. The "small" V.O.T.T.'s are in most peoples judgment, very large loudspeakers. Given this and the fact that they worked too well , people installed A7's into spaces that needed A4's or even A2's. I have seen A7's in 1500 seat theatres! This practice led to garbled dialogue and failures, especially in the smaller 1" H.F. Drivers. Lately as sound pressures have increased the failures have also, giving the speakers a negative reputation.

ALTEC itself was not entirely innocent in this problem. Their advertising department overstated the speakers capabilities, and in an effort to remain cost-competitive, certain practices were not included in production. The result was degraded sound quality. All in all, the small V.O.T.T.'s have minor problems compared to some of their rivals. Following this section is my breakdown of the problems I see in these speakers. The drivers of the A5 system are covered in

the previous large V.0-T.T. writing.

Problem - Deterioration

Some of these units are forty years old. In some the bass boxes have been damp, resulting in plywood delamination. Others have been victims of collisions. Probably the most prevalent problem is that of driver deterioration. I have seen woofer cones with their outer edge compliance (hinge) broken. Others due to time and/or dampness have rubbing voice coils. In some H.F. drivers the aluminum diaphragms eventually fatigue and break and other drivers, due to time and abuse, are now out of alignment with rubbing voice coils. Possibly the least noticed and most prevalent problem is that of declining magnetism in older Alnico magnets. This evidences itself as loss of. midrange in woofers and loss of extreme high end in H.F. drivers. It is not odd to to find 10 to 20% magnetic loss due to the age of the units; this goes for all Alnico magnet drivers, not just ALTEC'S. In drivers that have failed from overpowering or physical abuse, a 50% magnet loss is not uncommon. Reconing does not solve this, only remagnetizing does.This may explain why some drivers, especially H.F. units, repeatedly fail despite re-diaphragming.

Failures of older deteriorated units often occur when new higher powered amplifiers are installed in system upgrades.

Problem - High Frequency Drivers

If you think the changes in the 288 drivers of the large units are many, just look at the changes in small"Voice of the Theatre's" (Fig. 4). As with the 288s of the large units, all the "small format" (1" exit throat) drivers of the smaller V.O.T.T.'s are excellent sounding units. This author believes the ferrite magnet 902 and 909 drivers to be the best sounding of all, followed closely by the Alnico magnet 802s, then the 804/806s, the ferrite 908s, the Alnico 808s, and lastly the 807s.

The main complaint about the 802, 804, 806 and 902 drivers is low power handling. Some operators have installed the heavier higher power "Symbiotic" composite diaphragms into these units which makes 802s into 808s, 804s and 806s into 807s, and

902s into 908s. This type of driver was standard in the A7 (807) and A7-500 (808) in the early 1970's, but were replaced because they didn't have the transient response of the 802 and 806 drivers-that were then reintroduced. Units re-diaphragmed with these "Symbiotic" diaphragms share this lack of transient response. In 1988 ALTEC introduced the 909 driver which has the fidelity of the 902 and the power handling of the 908 "Symbiotic" diaphragm model.

The 1" drivers of the 800, A7,A7-500 and the original A6 all have 1.75" diaphragms. According to acoustic watt calculations based on the 1.75" diaphragm to 1" throat driver, we find that this style of driver is capable of covering a maximum of 410 seats (theatrical standard of 200-225 cubic feet of air per seat) at regular cinema sound pressure levels. Beyond this level, the driver phasing plug distortion rises dramatically and is offensive to most people, especially women who generally have more acute hearing than men.

All 1.75"/l" compression drivers share this problem (JBL,TAD, Renkus, Heinz, Fostex, TOA, Radian, etc), not just ALTEC. The regular tangential compliance aluminum diaphragm of the 802, 804, 806, and 902 drivers expire with repeated use above this level.

The composite diaphragm models 807, 808, and 908 and the new tangential "Pascolite"diaphragm 909 drivers will survive under this abuse. This is the reason that during especially loud passages in larger theatres these speakers may sound "gritty" in the high end, a condition known as "driver cry". This does not mean this size of driver is "no good", only that the space they are in is often too large for them. With the imminent increase in dynamic range in future film audio, this problem will get worse. Replacing these drivers with larger diaphragm units like a 288 or 299 would be advised in these spaces.

Problem - High Frequency Horns

The original A6 and all A7s used 811 800 Hz sectoral horns. The A7-500 used a 511B 500 Hz horn. Both horns had a 90 degree horizontal and 40 degree vertical pattern. The 811 horn was intended for a maximum "throw" of 50 feet. The 511B horn was intended for a maximum "throw" of 65 feet. Within these confines both horns are fairly good mid/high frequency projectors.

The first A7's and all the original A6s used the heavy sand cast 811 horn. Later A7s used the two-piece die cast 811B. The sand cast 811 is fairly well damped and exhibits only a small degree of bell induced horn ring. The 811B rings like a cow bell At higher sound levels the ring adds a harshness to the program. The 511B horn rings worse than the 811B. Recently ALTEC has damped the horns by installing rubber pads between the webs of the mouth braces.

The 800 system used the H-808 2x4 cell small multicell horn. It was a 70 degree by 35 degree horn and was too narrow for some theatres. It was also expensive to build and had all the same problems associated with multicell horns. It possibly worked best in narrower theatres. Some people like multicells; you must judge their performance for yourself.

Problem - Woofers

The woofer of the early 800, A7 and all original A6s was the 803A. It was a cheapened version of the early 515(no suffix) Woofer. It had a paper hinge and didn't reproduce the low notes adequately. The 803B woofer used in A7,s and A7-500's greatly increased bass output with a slight loss of midrange. It was a multipurpose unit that could be used in horns, vented boxes and sealed cabinets. it was replaced by the 416A which was merely a production refinement of the unit.

Around 1970 all small "V.O.T.T.s" converted from 16 to 8 ohms and the woofer became the 416-8.X, which is merely a 416A with an 8 ohm voice coil.

The fifth woofer was 416-8B, a 416-8A with the 16 inch frame and improved magnet structure. It worked better than its predecessor.

The sixth unit was the 416-8C woofer, a ferrite magnet version of the 416-8B.

The final woofer, the current one, is the 515-8G woofer. This unit is far superior in fidelity, bass, midrange and efficiency to its predecessors.

The L.F. boxes of the small "V.O.T.T.'s" are not near as critical to the woofers as the larger units. With the exception of the 803A woofer, all work well. The 515-8G exceeds all others in performance.

As with the H.F. drivers, if you are destroying woofers, then your speaker system is probably too small.

Prob lem - Bass Cabinet

The first cabinets, the 825 style (825's have a two-piece rear panel with only the top part removable), were made out of 5/8" plywood with minimal braces. These cabinets use a great deal of energy in wiggling the box.

The 828 (introduced in 1970) was first built for rock musicians The first ones had 2x2 rails on the outside of the full length rear panel to protect the crossover or musician ' s BiAmplifier during —moving. It was built with 3/4" material and was far stiffer than the previous 825. It was introduced to theatres in 1976..In 1981 the 828G replaced the 828 and changed the 2x2's on the back to an internal brace. The internal flare volume was isolated and Unfortunately the box material reverted to 5/8" particle board. This . enclosure needs more bracing.

In early 1989 the 828H replaced the 828G and is made with much stiffer 3/4" particle board, it still could use .re bracing.

All 825-828 cabinets are not rigid enough in the horn flare. This degrades the midrange performance.

For many years ALTEC published plans people to build this cabinet and many were built. Sometimes builders did a fine job, other times the result was cabinets that looked like 825-828's but were very flimsy. You can usually tell if cabinets were factory units by the "Voice of the Theatre" decal on the side. Unfortunately, I have seen a few miserable homebuilt examples with the V.O.T.T. name on them as the decal was available from ALTEC literature.

The 825 and early 828's have a little too much reflex space. in them. The 828G and current 828H are right on, they just need bracing. The H110 of the early A.5 has too much reflex airspace in it for the woofer; it also needs more bracing.

With the exception of the early AS (HllO) and the 800 system, none of the subsequent A5's, original A6's, A7's and A7-500's have wings (bass baffles) . An additional 100% of low bass could be gained by adding them, however, absolutely none of their competitors had any either.

Prob lem - Crosso vers and Matching Transformers

The N-800, N801, N-500 (small) , N501,N850, N1285 crossovers of the smaller V.O.T.T.'s are excellent units. The large N-500C and N-50OF of the A5's (and Al,A2, A4) are some of the best passive crossovers ever made.

This author believes passive crossovers have no place in professional audio and that the production of new ones ought to be banned. "Passive" crossover networks create all kinds of of problems. Firstly, even the good ones loose 25% of the amplifier power in insertion loss. They create frequency selective distortions such as L.F. harmonics showing up in the high frequencies using up driver headroom.

Since the early'1970's BiAmplification has become the preferred method of professional audio. Only recently has this practice been used in the cinema and then only in a few cases such as THX systems. Oftentimes matching transformers are used to match the amplifier to the loudspeaker. The 15067 autoformer is an excellent unit, however, it is another step in the audio chain and with any step it creates new program and looses other. The net result is most evident in the loss of transient response. Crossovers and transformers in tandem create a sonic disaster in any loudspeaker.

Prob lem Bogus Parts

For years reconers have rebuilt ALTEC speakers with aftermarket parts. Most times this ruins the performance of the driver. Currently the major supplier of recone parts sells a cone "for" the 416 and 515 woofer that is not rigid enough. This cone degrades the midrange performance in a horn cabinet. Their voice coil is not rigid enough and tends to delaminate.

Recently this supplier (and others) is supplying Taiwanese diaphragms as replacements for the ALTEC horn drivers. These resemble the Symbiotic types (808, 908, etc). These units sound dreadful when installed. They have no midrange and their voice coil is unstable and will bind in a short tenure creating distortion. They are also far cheaper.

Several firms including the aforementioned-firm are also selling Taiwanese drivers as direct replacements for the ALTEC drivers. While they look like the real thing, their performance is not comparable to' the ALTEC'S.

I have seen instances of ALTEC 30904 attenuator/equalizer modules installed in A7 type loudspeakers. These modules were made for use in a studio monitor and wipe out the midrange in a V.O.T.T. If yours has one in it, I suggest you remove it. For about fifteen years, starting in 1970, ALTEC made versions of the A7-500 as musicians P.A. speakers. They look similar, however, they had the composite Symbiotic diaphragm 808 driver with either an 800 Hz crossover (model 1208) or 1200 Hz crossover (1236). The system was meant to be played loud and overcome noisy audiences. While the high frequency horn and

driver were the same as the 1969 A7-500, the woofer was a model 421 which, although it could handle a lot of electrical abuse, is purposely non linear in response to the musicians market. The 421 lacks bass definition and transient response when used in a theatre system. Some have found their way into theatres.

Now that I have pointed out the system's problem , I must say they are minor compared to other loudspeakers. The faults I have described are only faults in the context of ultimate performance. The basic design of the classic Voice of the Theatre was very carefully done by some of the world's best loudspeaker designers. Most problems exist due to improper installation and maintenance.

Reno vation - W oofer

The first option of woofer update is to change them to current 515-8G or 515-16G woofers. Since we will ultimately Biamplify these systems, I will recommend the 8 ohm 515-8G for better power transfer from direct coupled transistor amplifiers. If you already have a 16 ohm system and reuse the crossover (please don't) you will have to use the 515-16G 16 ohm unit.

if you do not wish to use new woofers, we can renovate the older Alnico magnet units for a somewhat lesser end result. Remove the woofers and ship them back to the ALTEC factory for cleaning, realignment, reconing and remagnetizinq. Have the 803 and 416

woofers reconed with either R416/515-8 8 ohm or R416/515-16 16ohm recone kits. For 515 woofers in the A7 or A7xx, see the large V-0-T.T. writing. Do not have a local reconer perform this task as it is likely they will not use the proper cone and voice coil and most of these enterprises do not have a magnetizer. It is almost certain these units have lost 10 to 50% of their magnetism due to age and abuses especially if the unit has failed before. A woofer with a low magnet will not produce sufficient midrange needed for horn use. The ferrite magnet 416-8C and 515B (AS) woofers will not need to be remagnetized.

Reno vation - L.F. Enclosur e

The first step in updating these boxes is to increase the stiffness of the sides to prevent them from vibrating and using up low frequency energy . Screw and glue 2x4s on edge diagonally on the inside of the enclosure on all large flat areas of the reflex chamber. Cut smaller areas in half with 2x2s. There is no such thing as too much bracing. Further stiffening can be done by laminating particle board or plywood to the sides, ends and back of the enclosure with glue and screws. Use a minimum of 3/8 inch thick material and a maximum of whatever you wish.

The volume of the H-110 enclosure of the early AS is too large for the 515 woofer. Calculate the volume of the box and reduce it to 10 to 11 cubic feet. Port the reduced enclosure to 100 square inches. Follow the renovation plan as discussed in the large V-0-T.T. writing for this enclosure.

The 825-828 enclosure is nearly the right volume. Current 828's have the insides of the flare sealed off from the rest of the reflex chamber. Do this with the older units and the reflex volume, will be just right.

The horn flare of all the ALTEC 825/828 units vibrates and upsets the flat response of signal coming out of the mid/mid-bass horn; it needs to be rebraced. I have seen all kinds of fixes for this, from 1/2 inch of bondo and fiberglass on the inside, to filling the inside of the flare with concretes to boxing off the flare and filling the inside with sand. They all work, however, a method I have found works well is to box off the flare and drill a hole in the division board and fill up this area with 2 lb. urethane hard foam. Find an insulation contractor And have him blow in the foam.The 825/828 enclosure is ported appropriately.

With the exception of the 800 and early (H-110) AS none of the small units had bass baffles (wings). All theatre enclosures need bass baffles for maximum low frequency output. These baffles prevent the omnidirectional low bass notes from spilling behind the loudspeaker and wasting bass on non-audience areas. Baffles create a condition known as "half space" and give a resultant 100% increase in bass sound pressure levels.

Build new bass baffles, one on each side as high as the bass enclosure and as wide as you can; a full four feet works well. Baffle walls work even better. The wings were merely intended to be portable baffle walls in theatres in which the speakers had to be moved for stage events. Brace wings with 2x4ls every sixteen inches vertically, two feet horizontally. Use at least two knee braces to brace them to the enclosure. For speakers that must move,

fold the wings via hinges and demountable knee braces. Some smaller theatres do not have room for full wings between the speakers. Build baffles between the bass enclosures; use at least 3/4" material.

Reno vation - High Frequency Horn

If you ascertain that your theatre is within the size projection pattern and volume constraints of the small pattern horns and drivers, there are several options. The first one is to change the horn to the new MR-994A constant directivity horn. It will do all the things the 511's and 811's will do-only better. It holds its pattern better and doesn't ring. However, if you do not wish to do this, here is what to do.

There are two ways to get rid of the bell ringing of the horns. The best way is to add mass to the outside of the horn. Mask off the-driver flange mounting areas and coat the horn with fiberglass and resin, 1/4" of bondo.,Aquaplas, or my favorite, layers of sand held down by Latex paint. Keep adding mass until the horn will no longer ring when hit with your knuckles.

The second method is like that now used by ALTEC. Cut the weld between the horn mouth braces and replace it with a long life silicone gluelike Permatex blue gasket cement. I believe the "mass" method to be the better of the two, especially on the 811 which is smaller and easier to cover.

If you find your theatre is beyond the capabilities of the small pattern horns and drivers, change them to a 288 or 299 driver with a midsize MRII 500 series Mantaray constant directivity horn of whatever pattern you need.

Reno vation High Frequency Drivers

For those Voice of the Theatres with small pattern I" drivers the best course of action is to change them to new 909 drivers. All the small pattern ALTEC drivers are excellent sounding units and can be renovated with excellent results.

Do not use the smaller Alnico magnet size drivers 804, 806, or 807 in an auditorium over 300 seats.

Do not use the larger Alnico magnet 802 or 808 or ferrite magnet 902, 908 or 909 drivers in an auditorium over 410 seats.

If your theater's larger than 410 seats, switch to 288 or 299 drivers on an appropriate horn. I recommend a trip to the ALTEC factory for cleaning, realignment and remagnetization of all 800 series alnico magnet drivers. While there, have them install new 24620 8 ohm or 24621 36 ohm driver diaphragms. These units will then handle the same power as the 909 driver.

The ferrite macnet 902-908 drivers do not need to be re-magnetized. Replace the diaphragms with 909 types if needed. They will then become a 909.

For the 288 driver of the A5 speaker, consult the "Large Voice of the Theatre" writing.

Reno vation - Cr osso ver

Biamplify your renovated loudspeaker. The sound quality improvement is on the order of ten over the same unit with a conventional crossover. It is this author's opinion that it would be folly to use a passive crossover after all this work.

The only thing I can think of using a passive crossover for is for an emergency reserve with a conventional amplifier.

Biampli.ify, please, and whatever you do, don't use any speaker matching transformers anywhere.

Reno vation - Summary

Now that we have worked over our Voice of the Theatre system, we have a world class loudspeaker. These units have better midbass projection, less ballistic tonal difference between the high and low frequency sections higher overall conversion efficiency, and lower midrange distortion via the horn loaded bass cabinet than vented box systems. If you have followed my renovation plan, the deficiencies are now gone.

If you have changed H.F. drivers, horns or woofers to new models don't throw the old ones out. Small "Voice of the Theatre" parts make great Hi Fi speakers or surrounds in large theatres.

Reinstallation

If we have the world's best equipment, we can make it mis-perform by bad installation practices. Make sure you use the right high frequency horn for the space. If you do not have access to an ALTEC Array perspective programs lay the pattern of the horn out on blueprints of the auditorium seating and vertical section. While this is not completely accurate it's better than nothing.Another trick is to take a protractor and lay out the limits of the true pattern of the horn on its bell with masking tape.Raise the horn to its permanent position, look through the throat and see how it covers the seating inside the masking tape limits.

Since all the 511, 811 and MR994A horns are all 90 X 40 degree units, we have a problem if we need a larger or smaller pattern horn (unless we have a narrow room and an 800 system with its 70x35 degree multi-cell). If the room is a small amount wider than the horn it will probably be okay as the perforated screen enlarges the projection pattern.

If we-desire to change to 288 or 299,,1.4" - drivers, we must change the high frequency horn. A good choice would be either the mid-sized Mantaray MR11564 (60 X 40 degrees), MRII594A (90 X 40) or MRI15124 (l20x40).

If we still desire to use a 800 or 900 series 1" driver and need a pattern other than 90x40 degrees, we may attach them to either the 60x40 degree MRI1564 or the l20 X 40 degree MR115124 via a 21216 throat adapter. Please note that the MR994A 1" throat horn has identical projection pattern and bell size as the MR11594A (40 X 90) 1.41, throat horn.

If you have an original A6, this writer believes it imperative that you switch to a larger 288 or 299 driver on an appropriate horn such as an MRII500 horn. If you have renovated a larger "Voice of the Theatre, (A4,A2,Al), you can renovate and reuse one of the 288s you removed from it and replaced with new299's.

Now that we have the H.F. in hand, compare it to the projection pattern of the bass horn. An 825-828 enclosure has a midband projection pattern of about 90 degrees with the flare and 75 degrees opposite. In almost all cases we would set the bass enclosure in an upright position. Sometimes we would desire more Output in the L.F. section. One way is to combine two 825 or 828 bass horns like those of an original A6. Stack one on top of the other with the horn parts together. Bolt the units together. Make sure the woofers in both units are the same model and variant. Use a 288-or 299 driver on an appropriate horn for this new assembly as the low frequency potential will be enhanced by 3 db.

For powering these devices I of course strongly recommend bi-amplification. Renovated and new woofers hold about 75 watts of real continuous power. I recommend powering them to their maximum, even if you don't need the amplifier power. Drivers survive much better with clean peaks than clipped signals.

The 807, 808, 908, new 909 and 802, 004, and 806 drivers with 909 diaphragms have a 30 watt pink noise rating. Regular 802, 804,806, and 902 drivers have a 15 watt rating. 299 and 288 drivers with 299 diaphragms have a 50 watt pink noise rating. Regular 288 drivers have a 20 watt rating.

Generally I recommend 8 ohm woofers for all small "'Voice of the Theatre,,speakers. This effects a better power transfer from direct coupled transistor amplifiers. For the two woofer original A6 you may wish to use 16 ohm woofers for an 8 ohm total. If you have the adequate sized wire for less than a 10% wire loss, you may use 8 ohm woofers here instead for a new 4 ohms. Don't use matching transformers anywhere keep your fidelity.

Please don't use conventional passive crossovers, but if you must, you must use the proper impedance woofer for the crossovers. All "Voice of the Theatres" seem to biamplify best with 800HZ (811-H 308 horn) or 500Hz 12 db/octave slope electronic crossovers.18 db slopes sound unnatural (still far better than passive units) with these speakers. 24 db Linkwitz/Reilly type crossovers would be my second choice.

The last touch to proper installation is to align the high frequency assembly to the low frequency box. The easiest way to do this is the null method as described in ALTEC Application Note. This simple met@od requires only a 1/3 octave real time analyzer and a polarity switch. Do this as a final tune-up before equalization.

If you follow this guide, you can have a sound system that is among the best available. You may rest assured that it won't cost as much as new equipment and that these modifications can make your loudspeakers better than almost all new "off the shelf" models of their size category. I hope you have found this writing interesting and informative.

I would like to thank former ALTEC people Bill Hayes, Bill Scott Leslie, and current ALTEC people Ted Uzzle, Gary Jones, Jim Brown and Jerry Hubbard for their help and encouragement.Note: This was written several years ago, and the above persons, are longer involved with Altec.

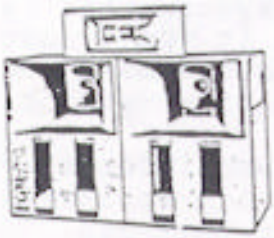
This document provided to the Altec community by wmeckle@uswest.net (Bill Eckle, Phoenix, Arizona USA]

Figure 8 Small "Classic "VOICE of the THEATRE" Loudspeakers

800 System

Original A5
(H-110)

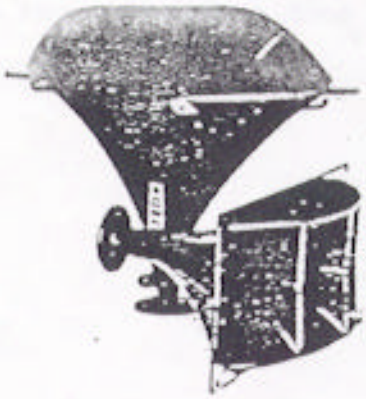
Later A5



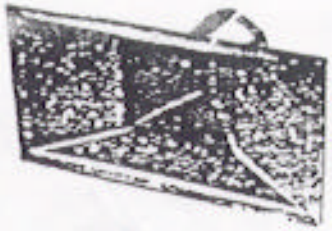
Original A6

A7

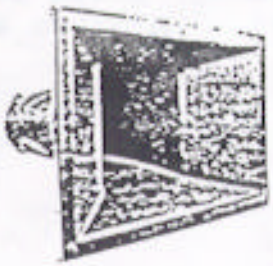
A7-500



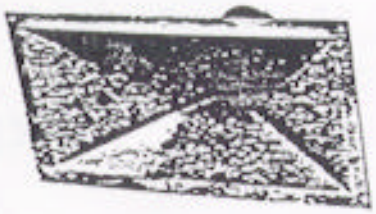
511B and 811B Horns



MRII594A Horn



MR994A Horn



MRII5124 Horn

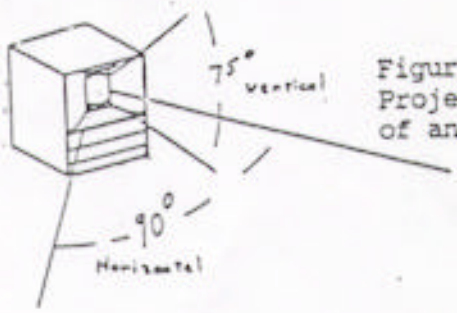


Figure 11
Projection Pattern
of an 825/828 Bass Horn
at midband.

MRII564 Horn

	Model	Tenure	Impedance	AES Power rating	Authors Recommended replacement Diaphragms	Authors Comments	Used In
					HIGH FREQUENCY DRIVERS		
	288	See "LARGE VOICE of the THEATRE" Driver Chart.				Large Format H.F. Drivers Used in A1,A2,A4,A5,A6etc.	
	802B	1946-1954	16 ohms	15 Watts	26420 8ohms 30 Watts 26421 16ohms 30 Watts (909 Diaphragms)	First permanent magnet small format high quality theatre high frequency driver. Gray Crackle Paint finish.	800 Early A7 Orig. A6
	802C	1954-1957	16 ohms	15 Watts	Same as above	Similar to above, Green paint finish.	A7,A7-500
	802D	1957-1972	16 ohms	15 Watts	Same as above *	Similar to above, Most plentiful 802, longest tenure. Most Green, later ones black.	A7-500
	802-8D	1972-1977	8 ohms	15 Watts	Same as above *	8 ohm version of 802D, all black	A7-500
	802 G series	1977-1980	8, 16 ohms	10 Watts	Same as above	Has new radial phasing plug, improved magnet structure. Originally equipped with very lightweight diaphragm. Has improved overall performance. Last ALNICO Magnet.	A7,A7-500 9845,9846 Model 19
	804A	1961-1964	16 ohms	15 Watts	Same as above	Small magnet version of 802C. 2Db less sensitive. Used extensively in Hi Fi and other loudspeakers. Green in color.	A7 844A Hi-Fi
	806A	1964-1972	16 ohms	15 Watts	Same as above *	New designation of 804A driver. Green Color	A7,8,9etc
	806-8A	1972-1975	8 ohms	15 Watts	Same as above *	8 ohm version of 806A. All black in color.	A7-8 etc.
	807-8A	1969-1974	8 ohms	30 Watts	Same as above **	Used in first 8 ohm A7. Composite Diaphragm (Symbiotic). Same Magnet as 806, has some less H.F. transient response than 806. Used extensively in Musicians P.A. Loudspeakers.	A7-8,1202 1203,1218 1219, etc
	808 A series	1969-1977	8, 16 ohms	30 Watts	Same as above **	Symbiotic Diaphragm model with 802D magnet structure. Electrically durable but also has less transient response than 802. Used in first A7-500-8. Used in Musician's P.A. Later 808s follow magnet development of 802	A7-500-8 1204,1205 1208,1209 1234,etc.
	902 A Series	1980-1983	8, 16 ohms	10 Watts	Same as above	Entirely new driver with ferrite magnet. Has the same radial phase plug as the 802G. Replaced both 802 and 806 drivers. Much thinner driver than older units. Originally built with very light and fragile diaphragm. Sounds fabulous, My favorite.	A7,A7-500 A8, 9844 9849,814 815, 819 etc.
	902T	1980-1982	8 ohms	15 Watts	Same as above **	Same as 902-8A but has diaphragm loading cap installed inside the rear cover to stop diaphragmatic over excursion on 500 Hz crossovers. Doesn't sound as good as 902 A.	A7-500 etc.
	902 B series	1981------	8, 16 ohms	15 Watts	Same as above **	Has the same rear loading cap as 902T and has a magnetic centering ring which seals off the magnetic structure. Reverts to older style diaphragm. Doesn't sound as good as 902 A series, handles more power.	A7-8G, A8 815,819 9844,9842 9872,M400
	909 A Series	1988------	8, 16	30 Watts	Same as above **	Newest ALTEC Small Format H.F. Driver. Has the same magnet structure and good sound quality as 902 and handles twice the power. Costs the same. When rediaphragming older 800 and 900 drivers use its diaphragms.	
Note: The diaphragm loading cap as explained in 902T driver prevents over excursion of the diaphragm at lower H.F. horn limits. While it prevents diaphragm failures it also slighty reduces the naturalness of H.F. sound quality. Loading caps have come and went throughout the years. Certain variants of driver have been produced both with and without them. * denotes models built with and without caps, ** denotes those that always have had loading caps.							
					WOOFERS		
	515	See "LARGE VOICE of the THEATRE Driver Chart				15" Woofer used in A1,A2,A4,A5,A7xx,A9, original A10	
	803A	1947-1958	16 ohms	35 Watts	Custom R515 16ohms 75W	Smaller magnet version of original 515. Lacks low bass of later variants. Green.	800 A7 early A6
	803B	1958-1964	16 ohms	35 Watts	Custom R515 16ohms 75W Custom R416-8 8ohms 75W	Improved bass response with new cone shape. Excellent all around woofer. Green in color	A7,A7-500 Hi Fi
	416A	1964-1969	16 ohms	35 Watts	R416-8 8ohms 75 Watts R416-16 16ohms 75 Watts	Production refinement of 803B Woofer. Multi purpose loudspeaker. Can be used in both bass horns or vented boxes. Green in color.	A7,A7-500 A8, Hi Fi Etc.
	416-8A	1969-1976	8 ohms	75 Watts	Same as above	8 ohm version of 416A. Later versions were on 16 inch frame. Black in color.	A7-8 HiFi A7-500-8
	416 B Series	1976-1981 1988-1990	8, 16 ohms	75 Watts	Same as above	All units built on new 16" frame. Has improved ALNICO magnet structure. Best of all 803-416 Woofers. Brought back in late 1980s for a short period. Black in color.	A7,A7-500 A8, 9845 819, 816 817 etc.
	416 C Series	1980-1984	8, 16 ohms	75 Watts	Same as above	Ferrite Magnet version of 416 woofer. Does not work as well as 416 B series. Does work as well as 416A series. Black in color.	A7,A7-500 A8, 9845 819, 816 817 etc.
	515-8G	1984------	8 ohms	75 Watts	R515-8G 8ohms 75 Watts	Newest model of Venerable 515 series of driver woofers. Replaced 416 series in A7s. More efficient, cleaner midrange than all	A5X, A5C A7-8G A7-994A A[illegible]-700