WATT/Puppy
SYSTEM 7

WILSON AUDIO

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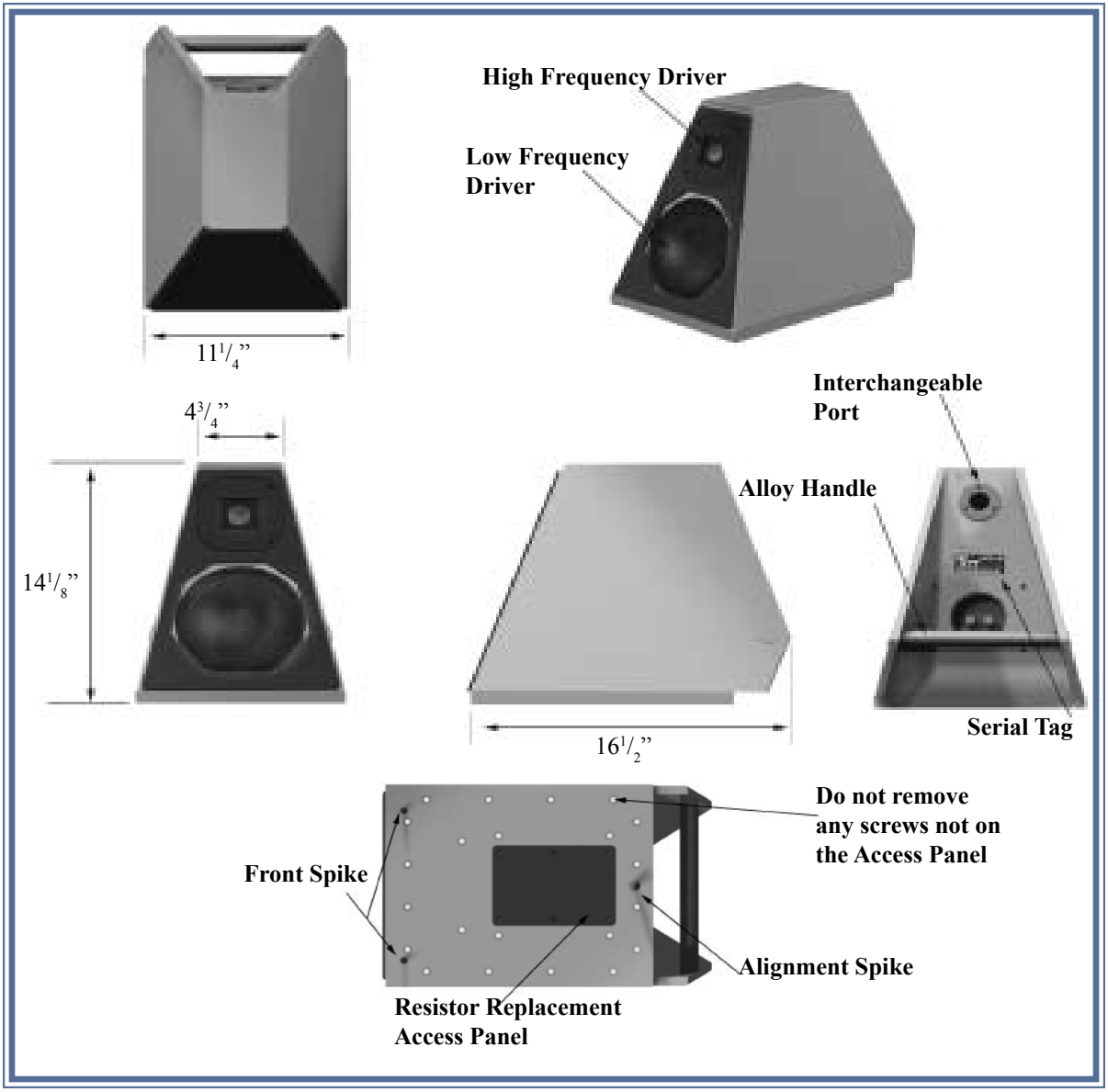
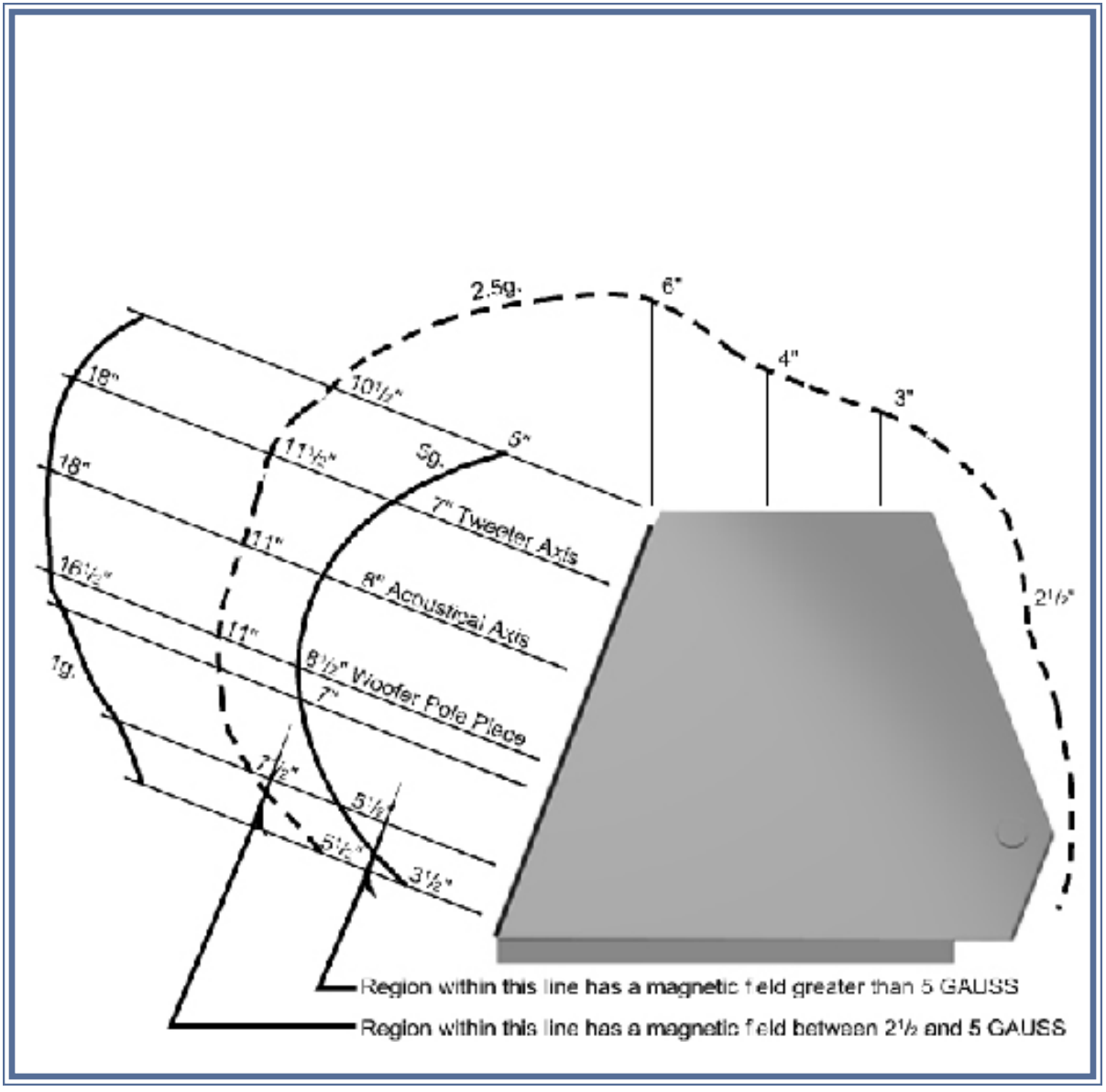
WATT System 7:

Components and Dimensions



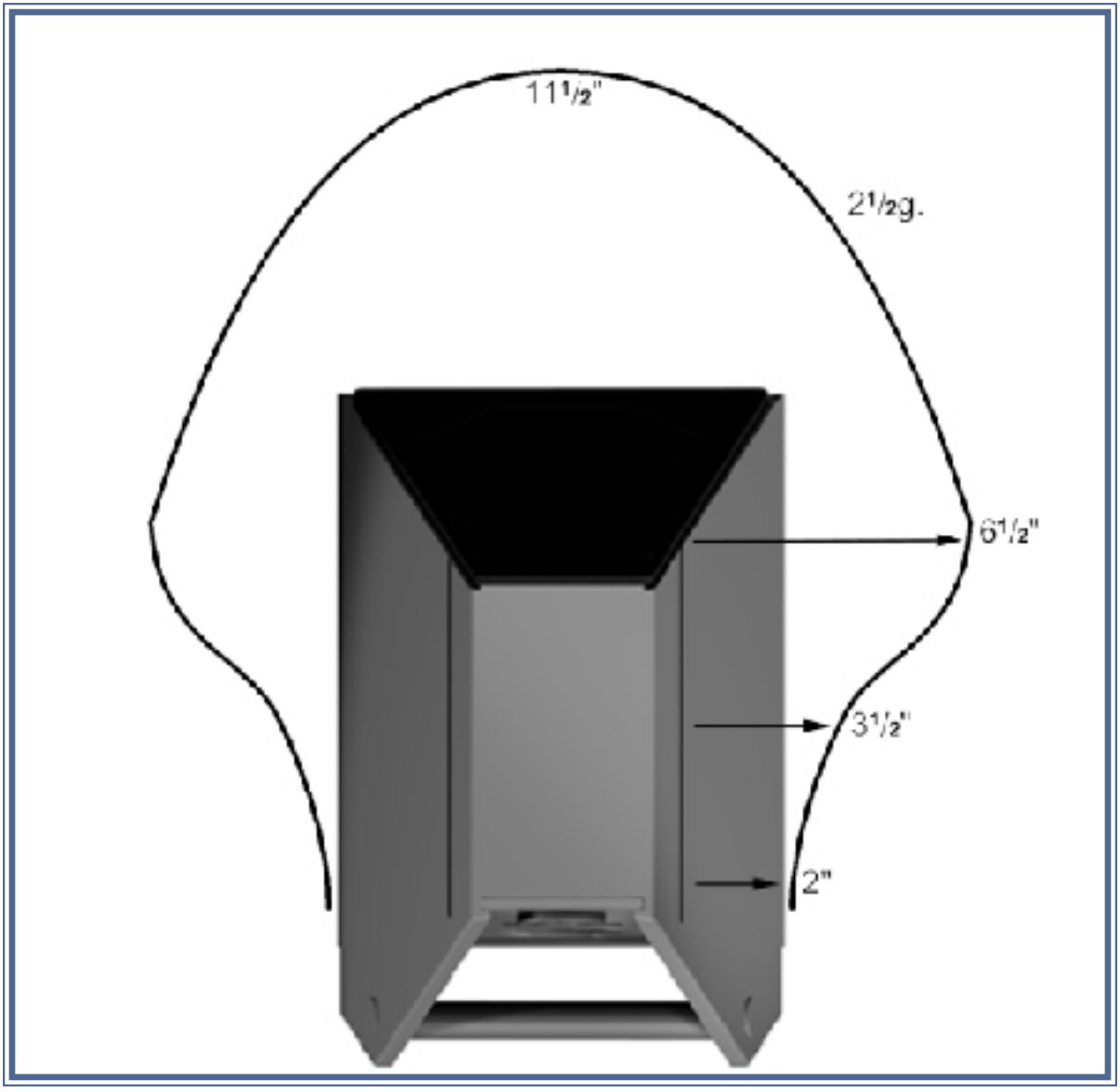
WATT System 7:

Magnetic Fields - Side View



WATT System 7:

Magnetic Fields - Top View



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Although they are two separate products, the Wilson Audio WATT and Puppy are almost invariably used together. Thus, it seems appropriate to combine information regarding their use into one convenient manual.

APPLICATIONS

Your WATT (Wilson Audio Tiny Tot) precision loudspeaker system was designed and developed by David A. Wilson to serve as a highly accurate yet portable professional monitor for on-location recording work. Microphone pattern selection and placement as well as master tape evaluations may be quickly and correctly performed using the WATT. The extraordinary transparency, coherence, and dynamic linearity of the WATT also make it ideal for the sonic evaluation of audio hardware and software, including associated electronic audio equipment, such as, amplification systems, D/A converters, passive circuit components, signal cables, solders, and contact treatments. Its capabilities of high resolution, accurate tonal and harmonic integrity, and unsurpassed sound-stage recreation make it an ideal system for the most demanding music lovers. In the application as a center channel for video systems the WATT (usually with A.V. Puppy), provides unrivaled dialogue intelligibility and convincing dynamics. The WATT's size and color options allow it to be integrated harmoniously into a wide variety of fine interior decors.

DESIGN CONSIDERATIONS

The WATT is designed around a massive, yet compact, enclosure utilizing proprietary polymer materials technology. The enclosure material exhibits excellent internal damping and a correct mechanical impedance match to the frames of the drivers. Additional mechanical tuning is provided by null point placement of lead alloy ingot blocks, bituminous surface treatment and rigid cross-bracing.The acoustical tuning of the low frequency system is modeled after the quasi-third order Butterworth response, (see figure 1 below), which provides linearity in the upper-bass (without the usual mid-bass hump) with superior transient performance. The low-frequency range of the system is normally extended with a Wilson Audio Puppy high speed woofer. The crossover network uses multiple slopes to achieve acoustical phase linearity. Minimum energy/ time-storage behavior in the crossover is achieved by using only the finest audio-grade

WATT DESIGN CONSIDERATIONS:

Thiele & Small Alignments

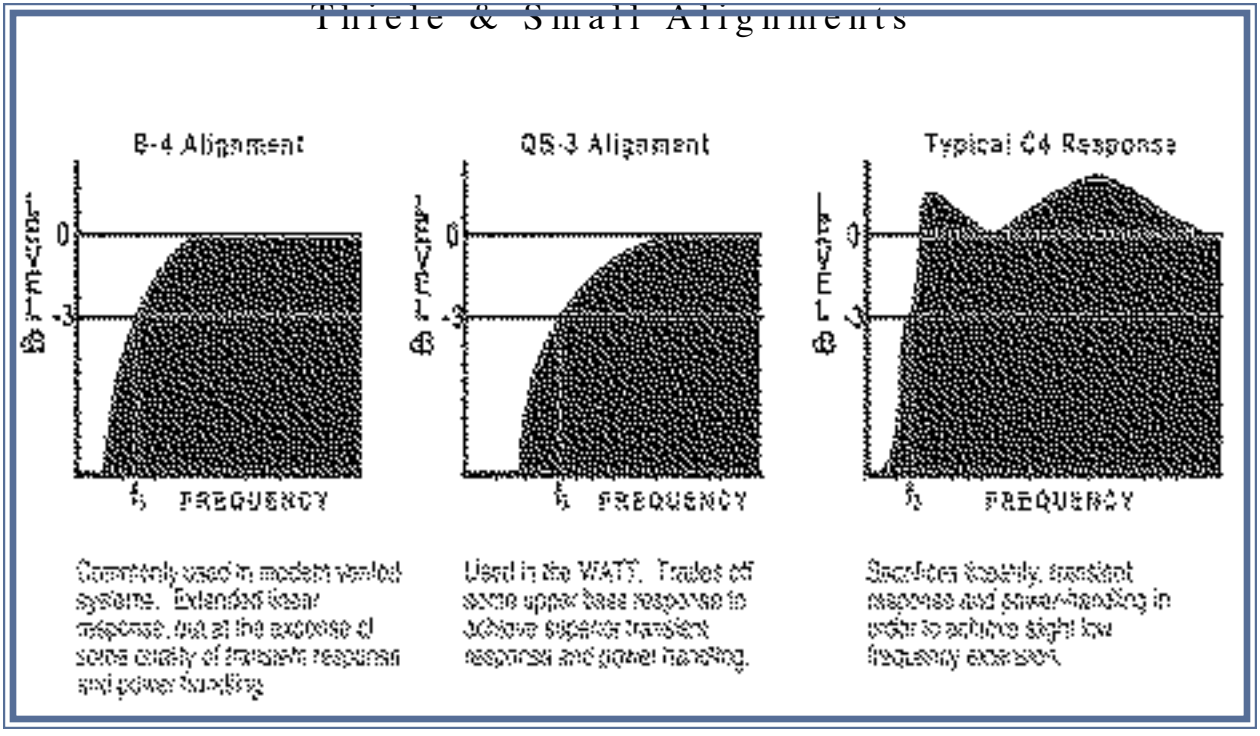


Figure 1

propylene capacitors, OFC air-core inductors, and time coherent wire. The components are matched to better than 0.1% tolerance. The drivers were selected because of their frequency response linearity, impulse stability, and most important, their intrinsic musical quality.

ENCLOSURE MATERIALS TECHNOLOGY

The original WATT established the textbook standard for sonically inert loudspeaker enclosures. It pioneered the use of exotic cabinet materials coupled with a new benchmark for construction quality, achieving a speaker enclosure that remains unsurpassed to this day. The System 7 employs the strategic use of a new cabinet material that, in conjunction with existing "X" material, serves to reduce cabinet colorations to levels below that of the already extraordinary System 6. Distortion, noise, and audible enclosure resonance are all substantially reduced in the System 7. This results in much greater clarity, resolution and tonal correctness as well as an enhanced sense of effortlessness and ease. Dynamics are more clearly defined and delineated. Music flows from a blacker background. This material has been chosen because it provides a nearly ideal blend of rigidity, mass, and internal vibration damping.

THE WATT ENCLOSURE MATERIAL SHOULD BE TREATED AS THOUGH IT WERE CERAMIC! THE MATERIAL WILL NOT BEND, BUT INSTEAD WILL CRACK. FOR THIS REASON USERS OF THE WATT SHOULD NOT TO ATTEMPT DISASSEMBLY OF THE SYSTEM.

THE WATT: A TEXTBOOK IDEAL

The following is an excerpt from Martin Colloms' book High Performance Loudspeakers , (4th Edition, pp.297-299. Pentech Press, London, 1991):

"Where price is no object, costly materials and techniques can be employed to generate the finest results. In one system example, the WATT by Dave Wilson, the enclosure benefits from many techniques to achieve a remarkably inert result. The following details are all considered influential, including the small size (approximately 9 liters) which naturally improves strength and also results in a small enclosure surface area with reduced acoustic radiation. The enclosure itself is a truncated pyramid; as a result the panels are non-rectangular and the internal surfaces anti-parallel. The latter minimizes internal standing wave modes while the former helps to disperse and moderate the usual plate resonances present in conventional enclosure panels. In addition the interior is lined with anechoic grade foam supplemented by a volume filling of polyester fiber.

The enclosure panels are cut from a dense, naturally inert composite - an acrylic, heavily loaded with ceramic and a mineral powder - which may be machined like marble. Higher frequency panel modes are controlled by a highly resistive bituminous laminate on the inner surface while the remaining fundamental resonances are handled by heavy, 20 mm thick lead slabs bolted into position with elastic mountings to provide tuned, seismic damping. Furthermore, the side panels are extended at the rear to form small triangular 'wings'. A massive alloy bar is bolted up between these wings, horizontally disposed and providing a stressed reinforcement for these largest radiating surfaces. Finally the finished mass of approximately 25 kg provides a heavy inert foundation for the two-way driver lineup to perform at its best. The performance attained in this enclosure design is an object lesson in the continuing importance of enclosure coloration in box speaker design.

Both mechanical impulse tests and listening have shown that this quality of enclosure has a dramatic effect in improving sound quality, particularly with transients, subjective dynamics, stereo focus and depth; as such it shows that despite considerable improvements, we still have a long way to go in the field of commercial enclosure design. However, this performance is achieved at high cost, approximately 15 times that of a normal enclosure

of this size."

CARE OF THE FINISH OF YOUR WATTS

Your WATT loudspeaker enclosures are hand-painted with Wilsongloss™ paint and hand-polished to a high luster. While the paint seems quite dry to the touch, final curing and complete hardening takes place over a period of several weeks. To protect the finish of the WATTs during final manufacture, shipment, and setup in your listening room, we have applied a removable layer of protective film over the finish. We recommend that this film be left in place until the speakers are in their final location in your listening room. Once you have determined their final position, remove the film by peeling it off. **Do not leave this film on indefinitely, as it will leave impressions on the paint.** It is important that the delicate paint finish of the WATT be dusted carefully with the dust cloth, which has been provided. We recommend that the following procedure be observed when dusting the speakers:

- Blow off all loose dust
- Using the special dust cloth as a brush, gently whisk off any remaining loose dust
- Shake out the dust cloth
- Dust the finish, using linear motions in one direction parallel to the floor. Avoid using circular or vertical motions.

Because the paint requires a period of several weeks to fully cure, we recommend that no cleaning fluids such as glass cleaners be used during this initial period of time. When the paint is fully cured, heavy finger prints and other minor smudges may be removed with a glass cleaner. Always use the dust cloth. Stronger solvents are not recommended under any circumstances. Consult your dealer for further information if required. Periodic polishing may be desired over the years to maintain the high luster of the finish. We recommend a non-abrasive carnuba-based wax and soft cloth.

Connection of Your WATT Speakers

The very high current input terminals located on the rear of your WATT 7 loudspeaker are color coded with a small plastic plug, so that RED corresponds to positive and black to negative, or common, or ground on the amplifier output. Be sure to connect the loudspeakers in phase with each other. We recommend the use of the very highest quality loudspeaker cables, particularly those designed for high frequency propagation correction and phase linearity. Beware of "zip cord" type speaker cables which will smear the sound from your WATTs, and limit their effective bandwidth. Also, do not use braided litz type loudspeaker cables as they will cause an unnatural brightness to the sound, compromise

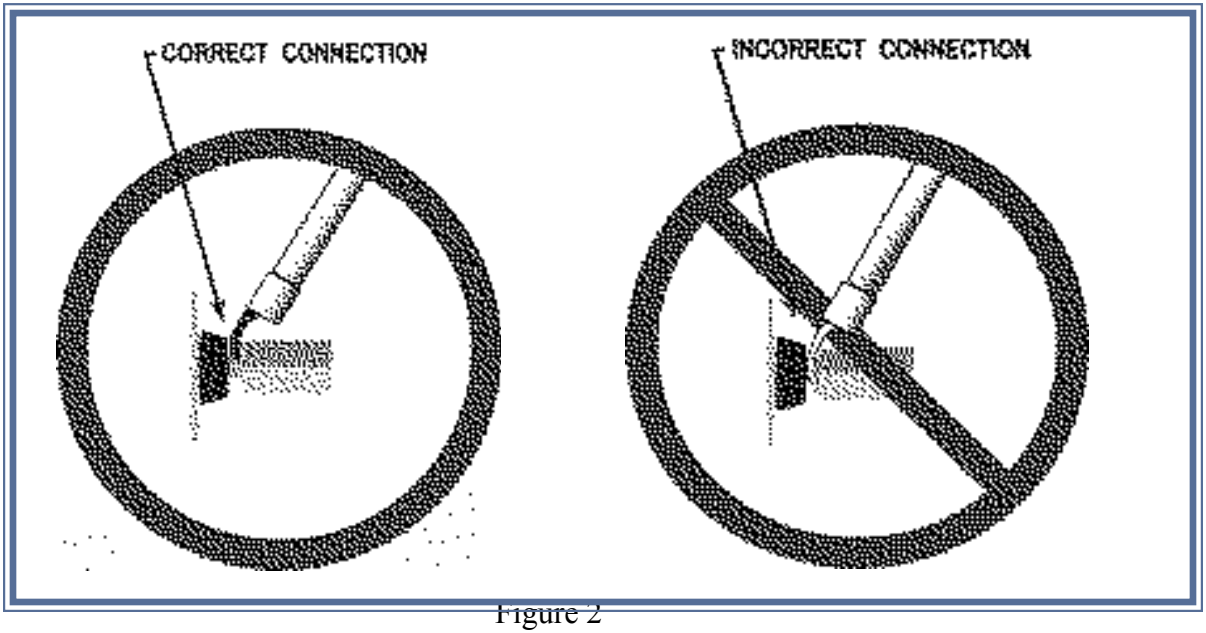


Figure 2

sound staging performance, and may cause instability, oscillation and damage in wide bandwidth solid state amplifiers.

The spade lugs of some of the high quality cables often used with the WATT/Puppy are *angled* to reduce pressures on the cable during installation. Avoid the instinct to push the cable's spade lug ends all the way into the WATT/Puppy's connectors *(see figure 2)*. **Partial insertion** of these *angled* spade lugs will actually improve the reliability of the connection. Flat lugs may be fully insert to connectors before tightening.

SELECTION OF INTERCHAGEABLE TUNING PORTS

The damping factor of an amplifier is a function of the amplifier's output impedance into a given load impedance. Solid state amplifiers, due to their intrinsically low output impedance, tend to have a higher damping factor than vacuum tube amplifiers. Vacuum tube amplifiers typically are transformer-coupled in their output stage and the secondary windings of the output transformer present a relatively high source impedance. This source impedance is a parameter which must be considered in the tuning of the air volume of the loudspeaker enclosure. An interesting theoretical consideration is that if a loudspeaker is designed around a solid state amplifier and then used with a vacuum tube amplifier, it will tend to sound loose and tubby in the mid-bass regions. The WATT loudspeaker system allows you to precisely tailor the air volume tuning of the enclosure to the amplifier of your choice.

Your WATT loudspeaker comes equipped with two sets of interchangeable tuning ports. The ports connect on the back of the loudspeaker system and are affixed with three (3) button-head stainless steel screws. An allen key is provided which can be used to remove these screws to facilitate exchange of the ports. Typically, WATTs are shipped with the "D.F. 100-400" ports installed. This range encompasses the majority of high performance solid state amplifier types. Most vacuum tube amplifiers have damping factors of from 20 to 80, and we recommend the port which is labeled "D.F. 20-80."

Mounting Heights

The acoustical center of the WATT speaker system is at a point near the top edge of the woofer, which we are referring to as "Point A." The system's phase coherence, as well as its upper midrange and high frequency amplitude response, are most linear when measured on axis with Point A. Placing the speakers above the listener's head displaces the alignment of the woofers' output in front of the tweeter. Such placement is possible, but ideally, the WATT should be angled down, toward the listener. Contact your Wilson Audio dealer for more information. The more common placement of the WATT is at or below ear level.

The effect of different mounting heights on the response of the WATTs is examined in figures 3 through 6.

WATT- on Floor

In the first example (figure 3), we see the WATT placed on the floor. In this configuration the WATTs low frequency response will be quite linear down to its lower band pass limit. Midrange to upper bass response is particularly smooth. If the floor is carpeted, the high frequency response will be somewhat depressed in amplitude, but clean. The soundstaging performance of the system will be hampered by comb-filter effects in the upper midrange and lower treble, which will also create a somewhat hollow-sounding coloration. Some listeners will prefer the mellow over-all tonal balance of this configuration, and indeed, several WATT systems incorporate essentially this placement with the WATTs mounted in consoles.

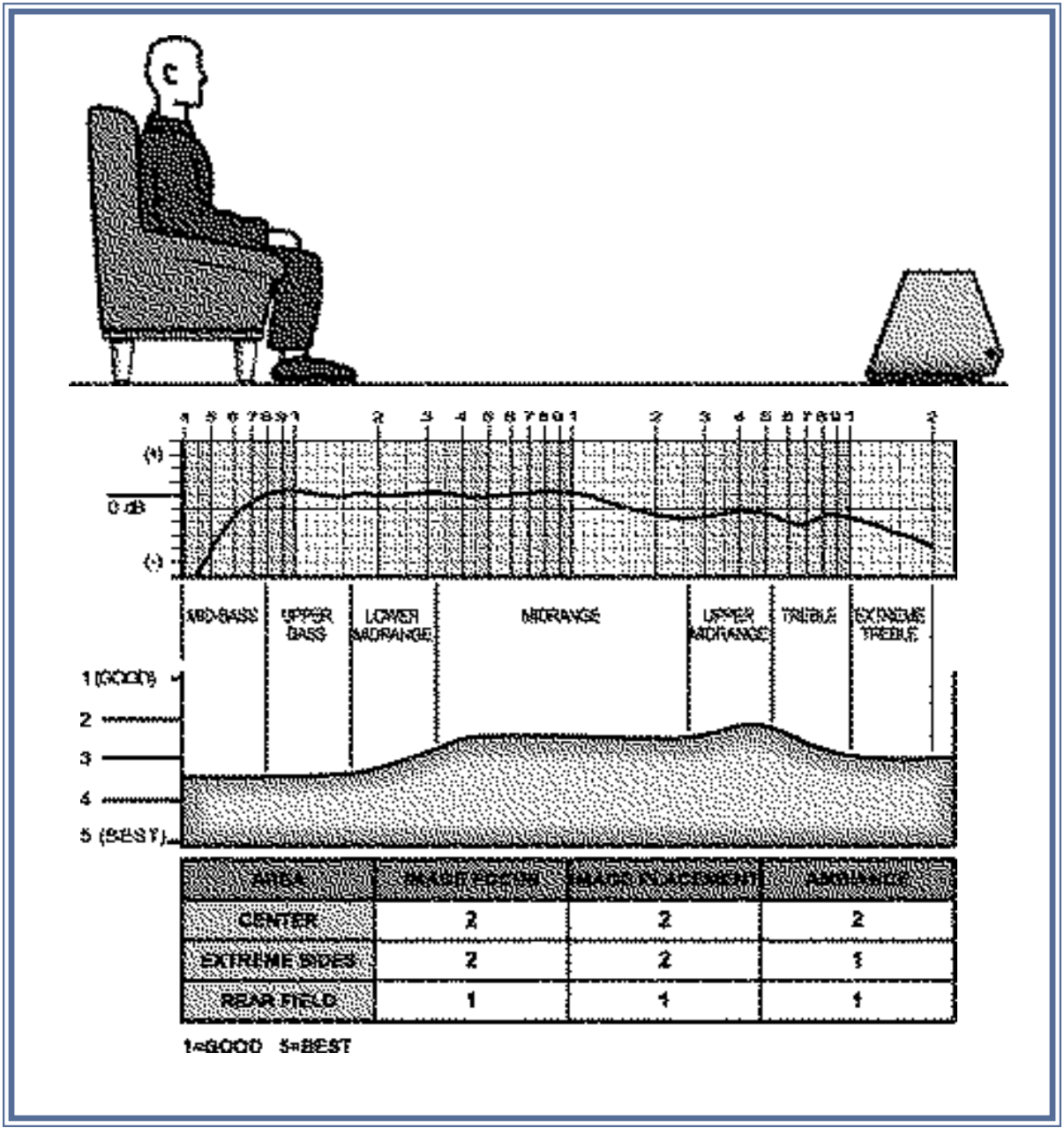

(+)
0 dB
(-)
MID-BASS
UPPER BASS
LOWER MIDRANGE
MIDRANGE
UPPER MIDRANGE
TREBLE
EXTREME TREBLE
1 (GOOD)
2
3
4
5 (BEST)
AREA
CENTER
2
2
2
EXTREME SIDES
2
2
1
REAR FIELD
1
1
1
1=GOOD 5=BEST

Figure 3

WATT- 18 Inch Stand

In the second illustration (figure 4), we see the WATT elevated to 18 inches above the floor on an open frame stand. There is some loss of low frequency response because of the reduction in 2 pi steradian support of woofer output. The acoustical center of the WATT is now closer to ear level, thus sound staging will be improved, and the high frequency response will be more linear than in the first example. Resolution of low level detail is im-

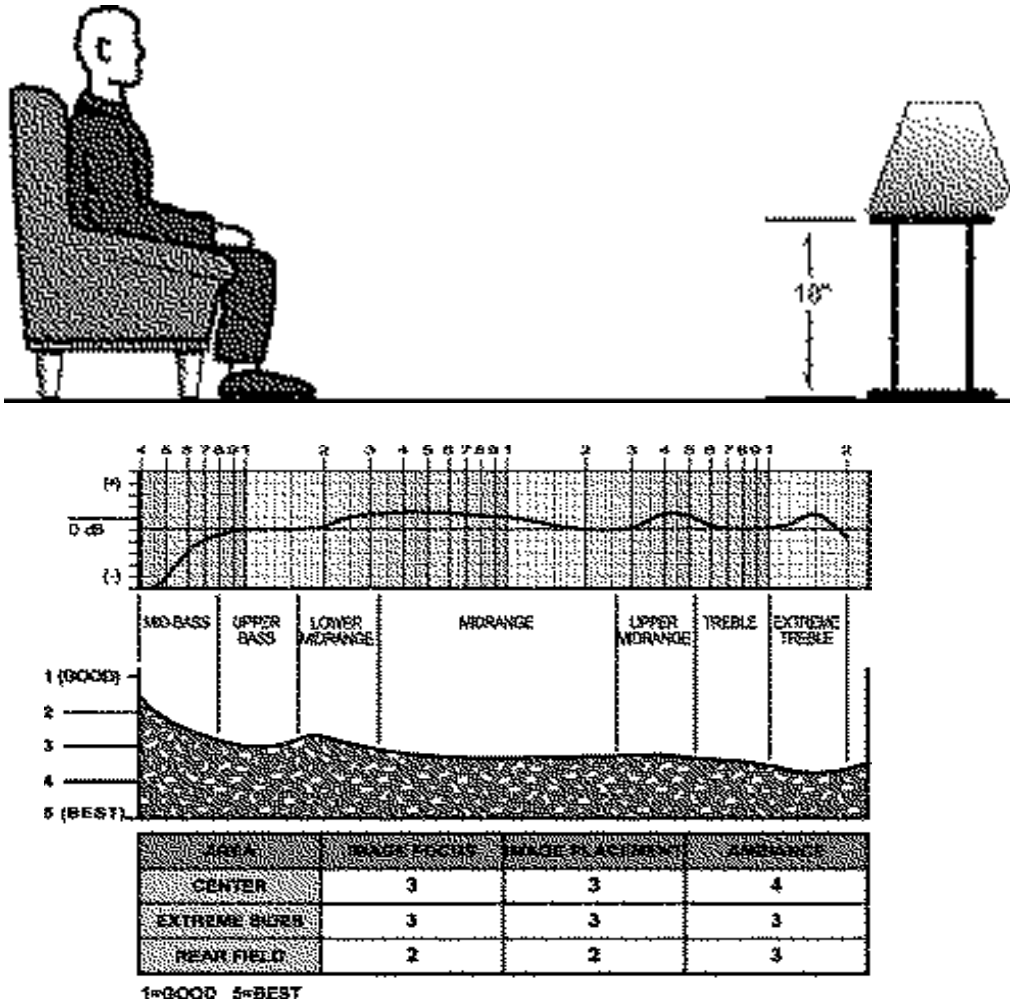


Figure 4

WATT-24 Inch Stand

The third illustration (figure 5), shows the effects of the speaker being raised an additional 6 inches off the floor. Here the sound staging properties will be excellent as will high frequency linearity and overall lucidity of detail. There will, however, be a noticeable loss in bass and lower midrange response due to the lack of 2 pi steradian support of the direct output of the woofer. Generally, as the WATT is raised up off the floor, the sound becomes "lighter" in balance as the speaker's height is increased. The recommended range of mounting heights is from 18 inches to 28 inches.

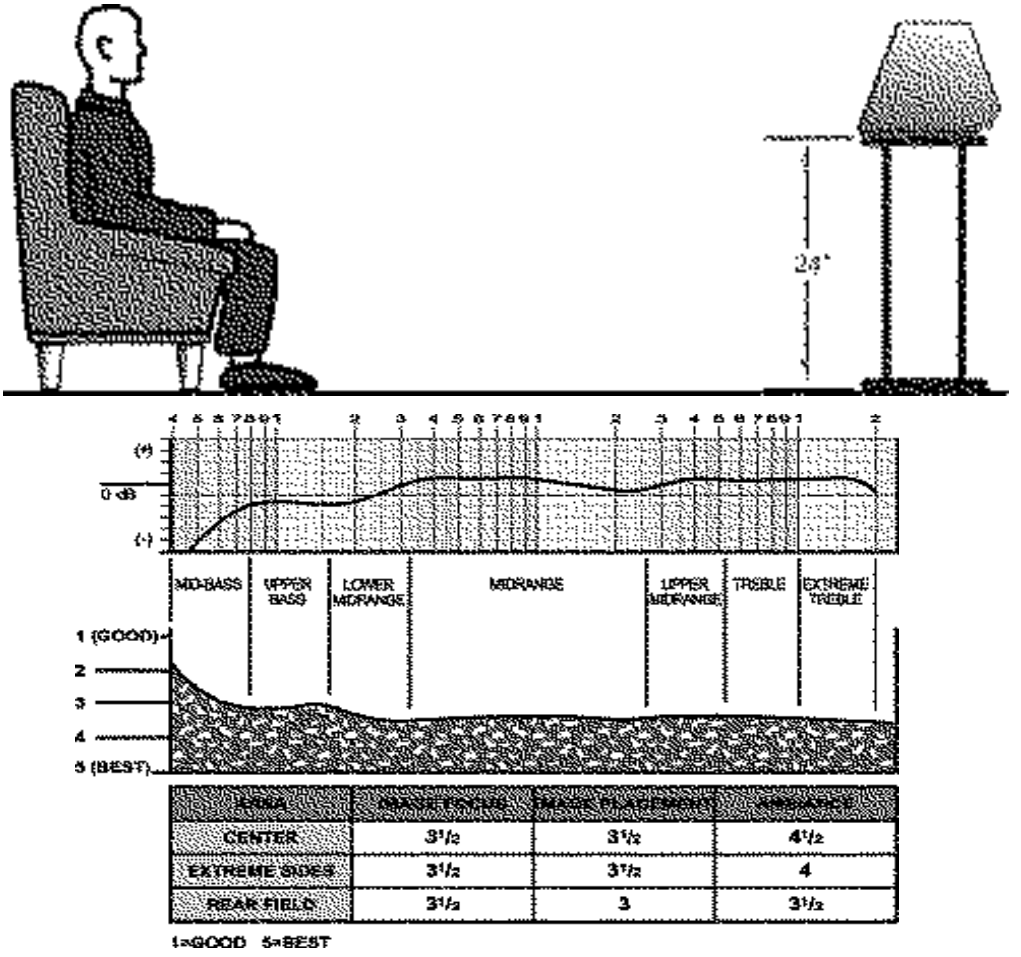


Figure 5

WATT on Puppy

In the fourth example (figure 6), we see the effects of mounting the WATT on the Puppy. This base provides the effect of 2 pi steradian support, and therefore results in a fuller, warmer, more rounded sound - even if the Puppy were not electronically connected. With the Puppy connected we see and extension of the base and a smoother, more even mid-range.

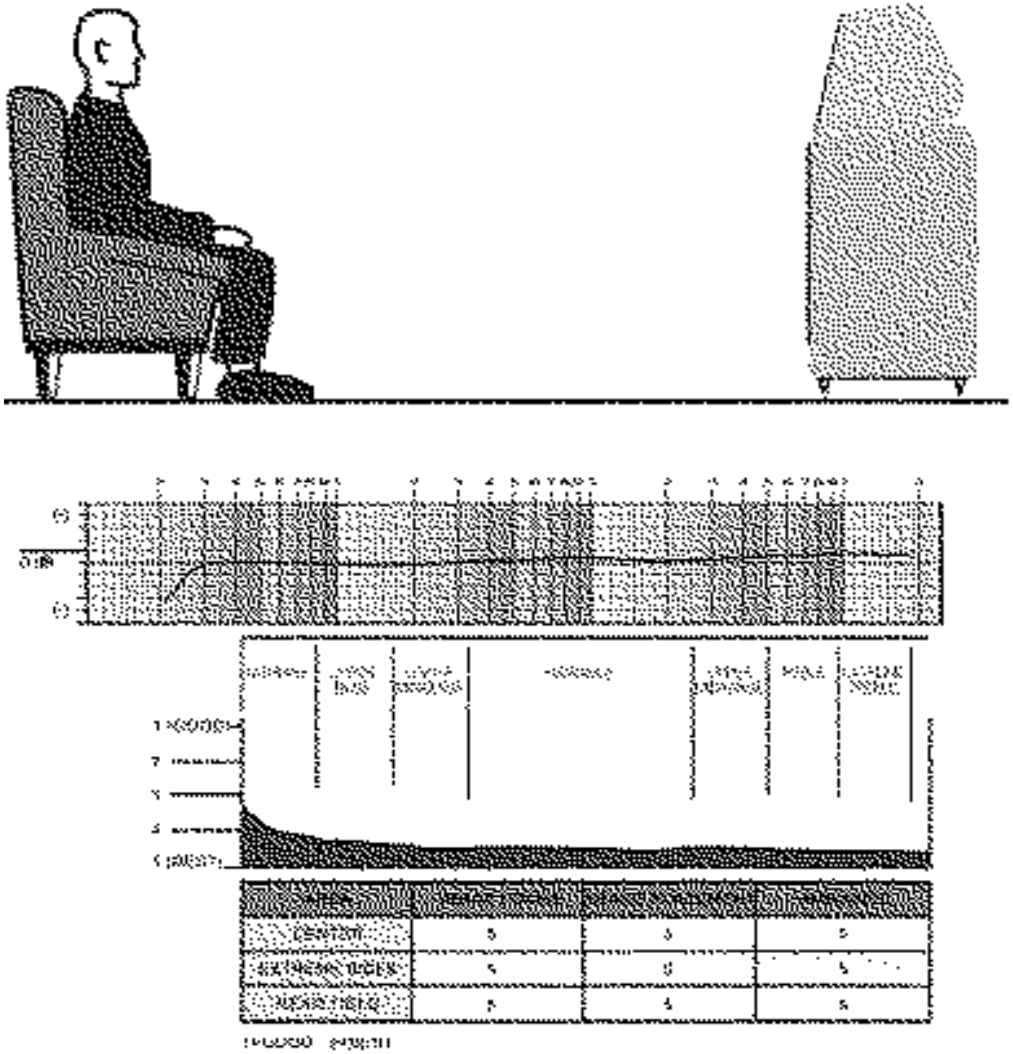
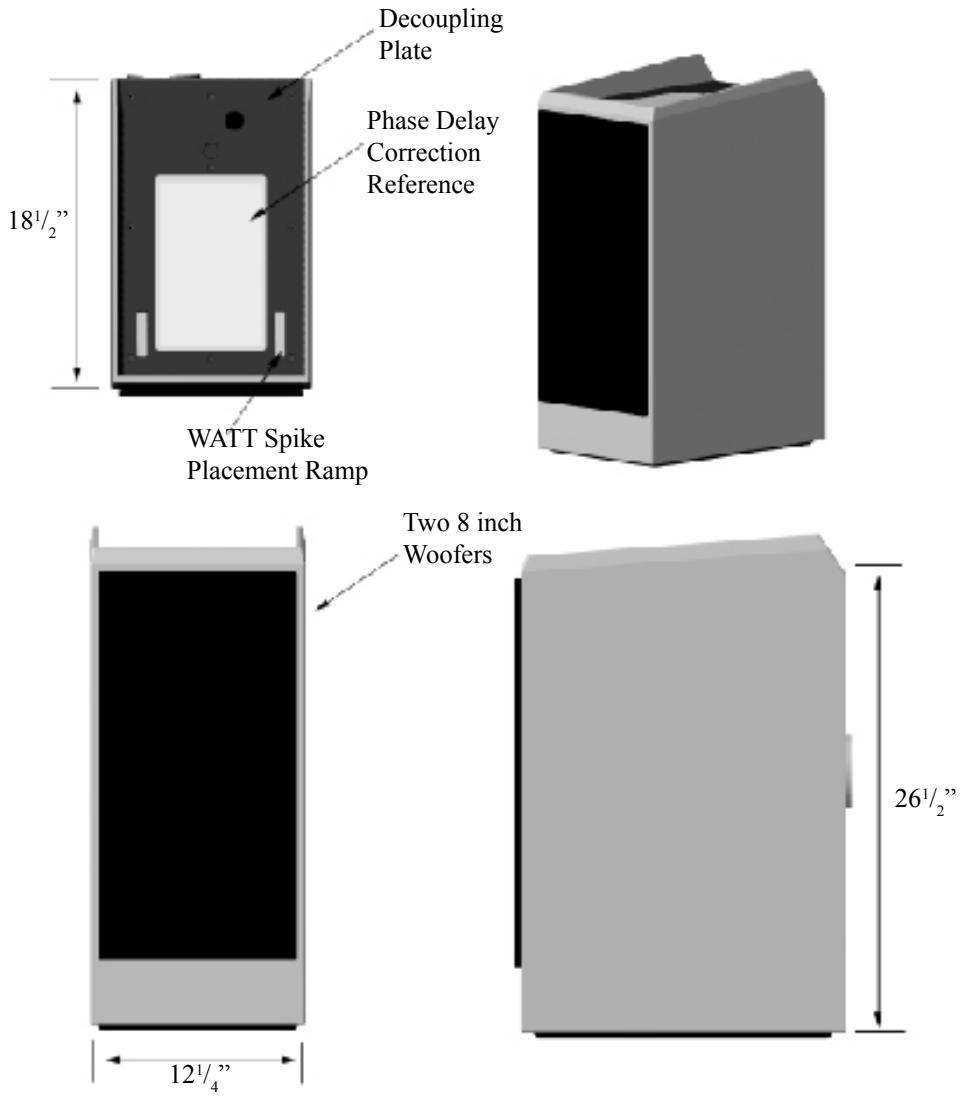


Figure 6

FOR BEST LOW FREQUENCY TRANSIENT RESPONSE AND CLEANEST MID-RANGE, ALWAYS USE SPIKED FEET ON THE STAND - BETWEEN THE STAND AND THE FLOOR, AND OPTIONALLY BETWEEN THE STAND AND THE SPEAKER. IF THE STAND HAS HOLLOW LEGS, FILL THEM WITH SAND TO ELIMINATE UPPER MIDRANGE RINGING IN THE STAND.

PUPPY 7:

COMPONENTS AND DIMENSIONS



Cabinet Design

At the core of each Wilson Audio loudspeaker design is the knowledge that to achieve the best performance in the world, you must start with the best materials. Here are just two of the in-depth engineering solutions that enhance the Puppy enclosure.

Material

The Puppy cabinet is constructed from a high-density, resin based composite. This composite meets and exceeds the highest of ANSI test standards for its use, while offering very tight tolerances, high hardness, uniform density, and dimensional stability. The high hardness of this composite not only offers excellent acoustical properties, but it also provides an ideal surface for painting. Thus, your high gloss finish will be as durable as it is beautiful.

Adhesive

What's in an adhesive? Everything. This often over looked element is crucial to the proper performance of a loudspeaker. Correct modulus of elasticity, coefficient thermal expansion and natural frequency response are just a few of the important elements.

A highly cross-linked, thermo-set adhesive is used for the construction of the enclosure. It was also chosen for its excellent bond strength, solvent resistance, hardness and optimum vibrational characteristics.

Depth of Design

The combination of the best in composite materials and adhesive technology, provided to us by the leaders in their industry, allow us to design an enclosure with unmatched performance. The Puppy cabinet has been designed to eliminate vibration and cabinet signature, while maintaining an internal acoustical integrity that is, quite simply, the best.

All of these structural aspects combine to allow Wilson Audio to deliver a product that maintains the strictest structural tolerances, durability and reliability. This also means that you will have consistent, repeatable performance, unaffected by the climatic conditions,

ORIGINAL DESIGN CONSIDERATIONS

The original Puppy high speed woofer was introduced in 1988, two years after the first WATT, series I. Prior to the Puppy, users of the WATT who desired more low frequency extension, would add various subwoofers from other manufacturers. The results were unpredictable and often compromised overall musical performance. It became clear to Mr. Wilson that none of these subwoofers provided the speed necessary to blend seamlessly with the lightning-quick WATT.

Thus, in the initial design phase of the Puppy, Wilson concluded that what was needed was a highly articulate, low distortion, non-resonant, compact high-speed woofer with robust power handling, high sensitivity and excellent reliability. In every series of puppy, two very high quality low-frequency drivers are driven in parallel in a rigidly cross-braced, tuned enclosure to quickly dampen spurious resonances in the structure. The crossover network in the base of the Puppy is always composed of the finest audio grade components, held to tolerances better than 0.1%.

PUPPY 7.0

The System 7 Puppy employs a new woofer driver. Bass performance, especially in the areas of transient speed and frequency linearity, is notably improved over any previous generation Puppy. Bass extension into the bottom octave is also slightly enhanced. The Puppy 7's bass performance is more consistent in a wider variety of rooms and environments.

Care of the Finish of Your Puppy

The standard finish of your Puppy is Wilsongloss™ paint. Painted Puppys should be treated as described in the section on Care of the Finish of Your WATTs (page 1-5). Do not, under any circumstances, use organic solvents.

T E C H N I C A L - N O T E

If the user wishes to test the polarity of the Puppy 7 with a battery, the plus (+) terminal of the battery is connected to the RED (+) input terminal of the Puppy and the negative (-) terminal of the battery is connected to the BLACK (-) terminal of the Puppy. The results of this test will show the Puppy woofers to move outward. This is the correct driver movement in response to a D.C. signal.

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ROOM REFLECTIONS

Figure 7 (below) illustrates the 3 most commonly encountered room reflection problems, slap-echo, standing waves, and comb filter effects.

SLAP-ECHO

Probably the most obnoxious form of reflection is the "slap echo." In slap echo, primarily mid-range and high frequency sounds reflect off of two parallel hard surfaces. The sound literally reverberates back and forth until it is finally dissipated over time. You can test for slap echo in any room by clapping your hands sharply in the middle of the room and listening for the characteristic sound of the echo in the mid-range. Slap echo destroys the sound quality of a stereo system primarily in two ways:

- Adding harshness to the upper mid-range and treble through energy time storage
- Destroying the delicate phase relationships which help to establish soundspace and image localization clues.

3 COMMONLY ENCOUNTERED REFLECTION PROBLEMS

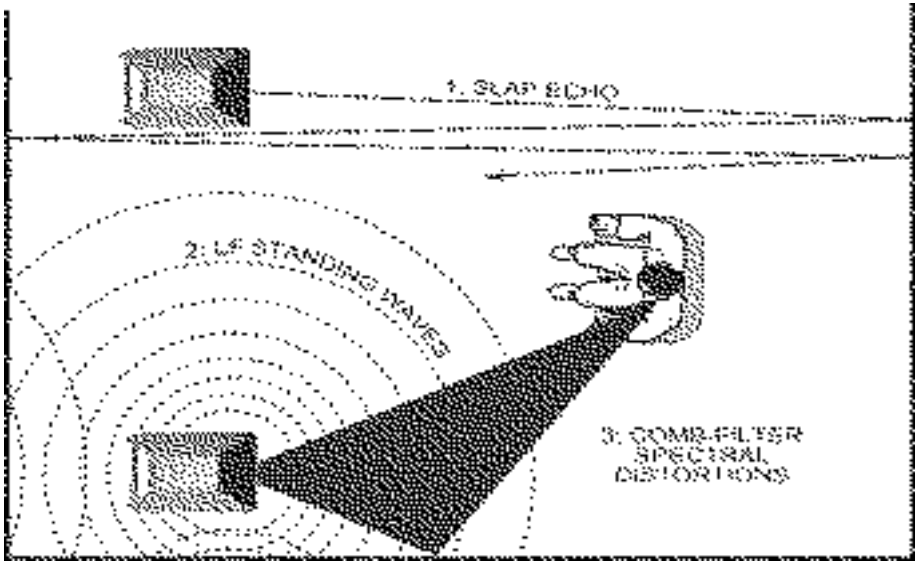


Figure 7

Non-parallel walls do not support slap echo, but rather allow the sound to diffuse.

Slap echo is a common acoustical problem in the typical domestic listening room, because most of these rooms have walls of a hard, reflective nature, usually being only occasionally interrupted by curtains or drapes. Slap echo can be controlled entirely by the application of absorptive materials to hard surfaces, such as:

- Sonex
- Airduct board
- Cork panels
- Large ceiling to floor drapes
- Carpeting to wall surfaces

In many domestic listening environments, heavy stuffed furnishings are the primary structural control to slap echo. Unfortunately, their effectiveness is not predictable. Diffusers are sometimes also used to very good subjective effect, particularly in quite large rooms. Sound absorbent materials such as described above will alter the tonal characteristic of the room by making it sound "deader,"much heavier in bass tonal balance, less "bright and alive" and "quieter." These changes usually make the room more pleasant for conversation, but sometimes render it too dull in the high frequencies to be musically involving. Diffusers, on the other hand, tend to not change the high frequency tonal balance characteristic of the room, but make the sound more "open". A combination of absorbtive and diffusive treatments is usually the best approach.

Standing Waves

Another type of reflection phenomenon is "standing waves". Standing waves cause the unnatural boosting of certain frequencies, typically in the bass, at certain discreet locations in the room. A room generating severe standing waves will tend to make a loudspeaker sound one way when placed in one location and entirely different when placed in another. The effects of standing waves on a loudspeaker's performance are primarily, as follows:

- Tonal balance-Bass too heavy
- Low-level detail- Masked by long reveration time LF standing waves

- Sound staging- LF component of image shifted

Standing waves are more difficult to correct than slap echo because they tend to occur at lower frequencies, whose wave lengths are long enough to be ineffectively controlled by absorbent materials such as Sonex. Moving speakers about slightly in the room is, for most people, their only control over standing waves. Sometimes a change of placement of as little as one inche can dramatically alter the tonal balance of a system because of standing wave problems. Fortunately, minor low frequency standing waves are sometimes well controlled by positioning ASC tube traps in the corners of the room. Very serious low frequency accentuation usually requires a custom-designed bass trap system.

Low frequency standing waves can be particularly troublesome in rooms constructed of concrete or brick. These materials trap the bass in the room, unless it is allowed to leak out of the room, through large window and door areas.

In general, placement of the speaker in a corner will excite the maximal number of standing waves in a room, and is to be avoided for most direct radiator, full range loudspeaker systems. Some benefit is achieved by placing the stereo pair of loudspeakers slightly asymmetrically in the listening room so that the standing waves caused by the distance between one speaker and its adjacent walls and floors are not the same as the standing wave frequencies excited by the dimensions in the other channel.

Comb Filter Effect

A special type of standing wave, noticeable primarily in the mid-range and lower higher frequencies is the so-called “comb filter effect”.

Acoustical comb filtering occurs when sound from a single source, such as a loudspeaker, is directed toward a microphone or listener at a distance. The first sound to reach the microphone will be the direct sound, followed by delayed reflected sound. At certain frequencies cancellation occurs, because the reflected sound lags in phase relative to the direct sound. This cancellation is most apparent where the two are 180 degrees out of phase. There is augmentation at other frequencies where the direct and the reflected sounds arrive in phase. Because it is a function of wave length, the comb filter effect will notch out portions of the audio spectrum at regular octave-spaced intervals.

The subjective effect of comb filter effects, (such as is shown in figure 8) is as follows:

- Added roughness to the sound
- Reduction of harmonic richness
- Smearing of lateral sound stage image focus and placement

Comb filter effects are usually caused by side wall reflections. They are best controlled by very careful speaker placement and by the placement of Sonex or air duct panels applied to that part of the wall where the reflection occurs.

Reflective Acoustical Comb Filter Effect

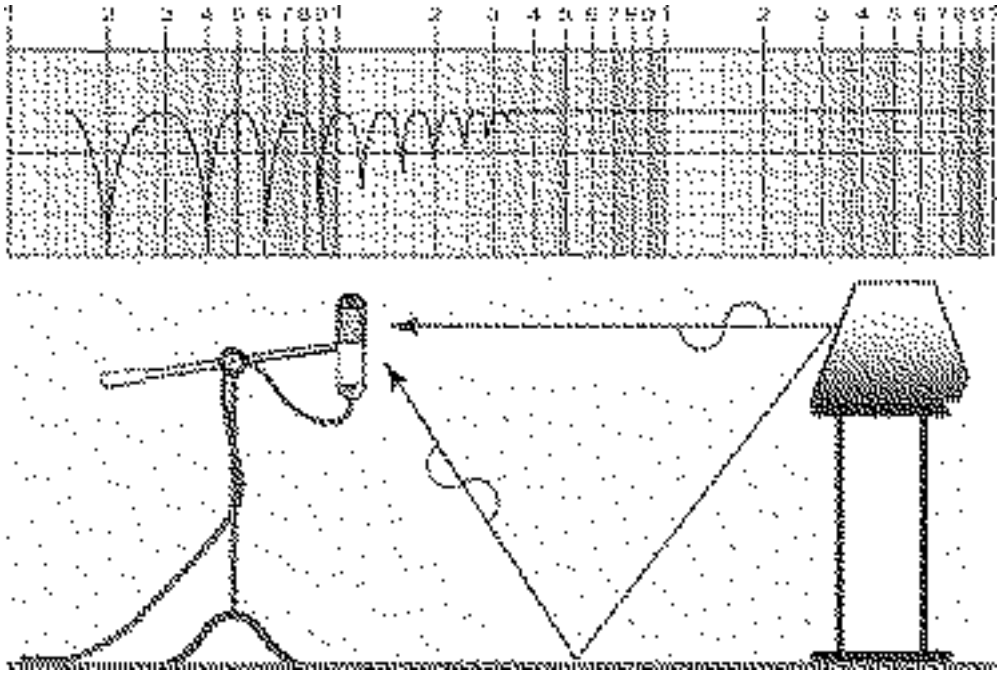


Figure 8

RESONANCES

Resonances in listening rooms are generally caused by two sources:

- The structures within the listening room
- The volume of the air itself in the listening room

STRUCTURAL RESONANCES

Structural resonances are familiar to most people as buzzes and rattles, but this type of resonance usually only occurs at extremely high volume levels, and is usually masked by the music. In many wood frame rooms, the most common type of structural resonance problem is "booming" of walls and floors. You can test for these very easily by tapping the wall with the heel of your hand or stomping on the floor. If it is a wooden floor, this is done to detect the primary spectral center of the resonance. To give you an idea of what the perfect wall would sound like, imagine rapping your hand against the side of a mountain. Structural wall resonances generally occur in the low to mid-bass frequencies and add tonal balance fullness to any system played in that room. They too are more prominent at louder levels, but their contribution to the sound of the speaker is more progressive. Rattling windows, picture frames, lamp shades, etc. can generally be silenced with small pieces of caulk or with blocks of felt. Short of actually adding additional layers of sheet rock or book shelves, to flimsy walls, however, there is little that can be done to eliminate wall resonances.

AIR VOLUME RESONACE

The volume of air in a room will also resonate at a frequency determined by the size of the room. Larger rooms will resonate at a lower frequency than will smaller rooms. Air volume resonances, wall panel resonances, and low frequency standing waves, together, combine to form a low frequency coloration in the sound. At its worst, it is a grossly exaggerated fullness, which tends to obscure detail and distort the natural tonal balance of the speaker system. Occasionally, however, there is just enough resonance to give a little added warmth to the sound... an addition some listeners prefer. Tube traps manufactured by the ASC corporation have been found to be effective in reducing some of these low frequency room colorations. While custom designed and constructed bass traps, such as perforated Helmholtz resonators, provide the greatest degree of low frequency control.

Room Shapes

There are three basic shapes for most rooms: square, rectangular, and L-shaped (see Figure 9). A perfectly square room is the most difficult room in which to set up speakers because, by virtue of its shape, square rooms are the perfect medium for building and sustaining standing waves. Standing waves are pressure waves created by the integration of sound and opposing, parallel walls which accentuate particular frequencies. They heavily influence the music played by loudspeakers, greatly diminishing the quality of the listening experience.

Long, narrow rectangular rooms also pose their own special acoustical problems for speaker setup. They have the ability to set up several standing wave nodes, which will have different frequency exaggerations depending on where you are sitting. Additionally, these long rooms are often quite lean in the bass near the center of the room. Rectangular rooms are still preferred to square rooms because by having two sets of dissimilar length walls, standing waves are not as strongly reinforced and will dissipate more quickly than in a square room. In these rooms the preferred speaker position for spatial placement and midrange resolution would be on the longer walls. Bass response would be reinforced, albeit not predictably, by speaker placement on the short walls.

In many cases L-shaped rooms offer the best environment for speaker setup. Ideally speakers should be set up along the primary (longest) leg of the room. They should fire from the end of the leg (short wall) toward the bend, or they should be along the longest wall, with the speaker furthest to the bend being inside of the bend. In this way both speakers are firing the same distance to the back wall. The asymmetry of the walls in L-shaped rooms resists the buildup of standing waves.

COMMON ROOM SHAPES:

OPTIMUM SPEAKER PLACEMENTS

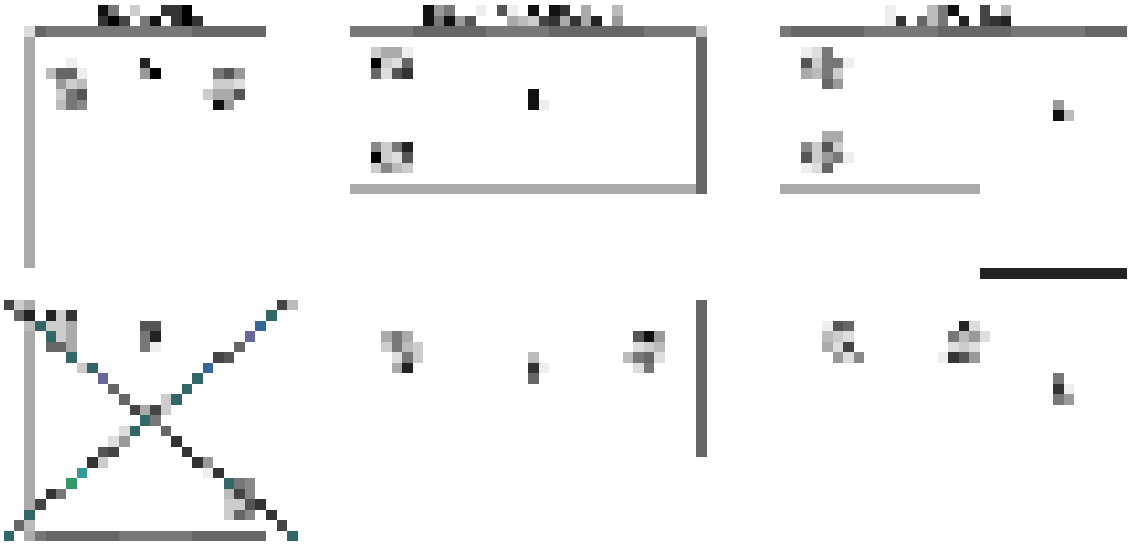


Figure 9

Effects of Room Placement

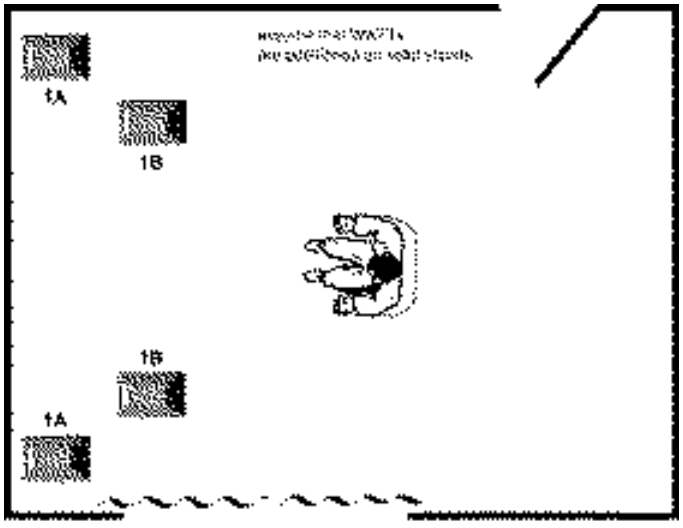
The WATT/ Puppy System 7s were designed to be aimed at the listener, which means that they will be toed-in prominently rather than facing straight ahead. The illustrations to follow will give examples of many common scenarios to assist you in the set up procedure.

The effect of room placement of the performance of the WATT is illustrated in figures 10, 11, and 12.

Corner vs. In room Placement (no toe)

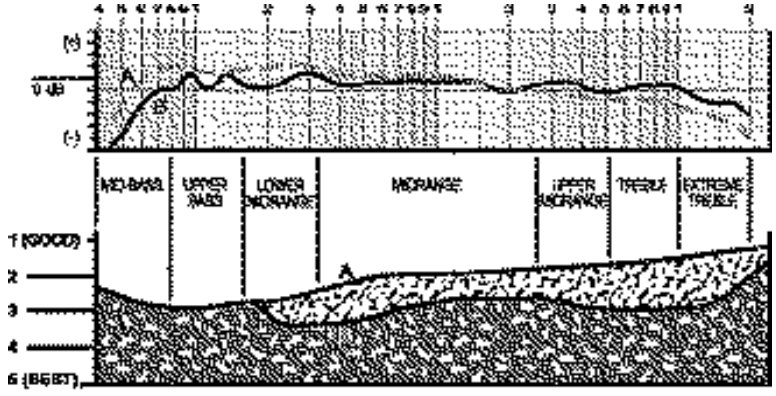
Figure 10 examples 1A and 1B and table 4 compare the performance of corner situated WATTs vs WATTs which are placed out in the room away from walls, but which are not toed-in. Placement of any direct full-range radiator loudspeaker in the corner results in numerous performance compromises. In one respect, however, corner placement of the speaker excels, and that is in low frequency augmentation. Looking at the tonal balance characteristic of the corner situated WATTs we can see an elevated lower midrange through mid bass region, the expected effect of corner loading, coupled with a gradual roll-off of the upper octaves, the result of any sound absorbing materials on adjacent walls, and the off-axis listening position.

The corner placed speakers are also significantly further away from the listener than the speakers in example 1B. By its very nature, sound, when traveling through air, loses low-level detail with distance. Ideally, therefore, the listener should sit as close to the speakers as is comfortable. Moving the speakers out into the room at least three feet from the rear wall, and at least two feet from the side walls, provides a fairly dramatic level of improvement of sound staging performance and overall mid and upper octave balance. But still the example shows the speakers not toed in. The WATTs are designed for maximum phase coherence and pulse replication accuracy when they are aimed directly at the listener or microphone.



EXAMPLE 1A: Illustrates the performance of corner installed WATTs.

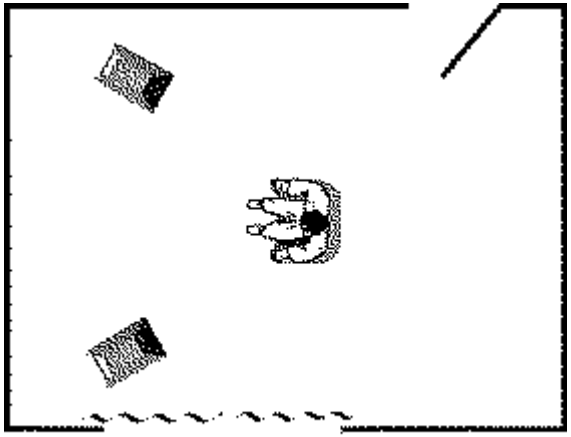
EXAMPLE 1B: Illustrates the performance of WATTs placed out in the room, away from walls, but not tight in.

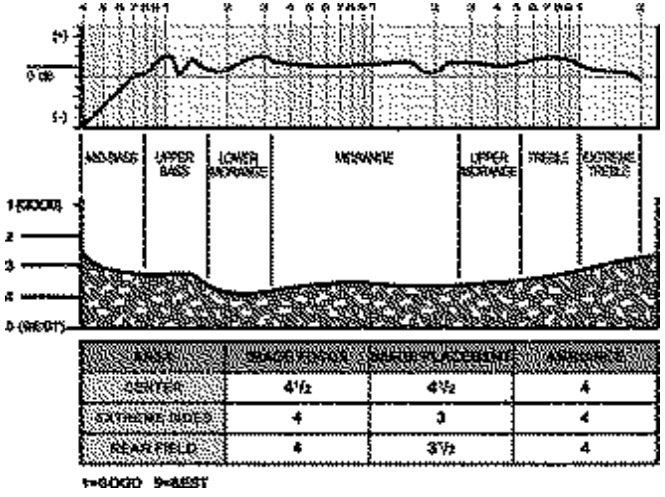


CENTER	A=2 B=3½	A=3 B=3½	A=2 B=3½
EXTREME SIDES	A=2 B=3½	A=2 B=3	A=2 B=6
REAR FILL	A=2 B=3	A=2 B=3	A=2 B=4

WATT- In room Placement (with toe)

Figure 11 shows the effect of toeing in the WATTs. The speakers in example 2 are in the same general room location as the speakers in 1B, but are toed in. When the WATTs are correctly toed in, the listener, when seated in the listening position, will just barely see the surface of the inner side panels of the WATTs. We can see that toeing in the speakers provides dramatic improvements in resolution of low level detail in the midrange as well as dramatic improvements in sound staging performance. It should be noticed that in the tonal balance curve in the table reveals irregularities in response in the upper bass through lower midrange. These are caused by standing waves and adjacent wall comb filter effects. The performance indicated in the table is very promising, and yet it is not really representative of the best performance of which the WATT is capable. Any speaker will benefit from appropriate acoustical room treatment.





EXAMPLE 2: Illustrates the effect of toe-in on the WATTs. Units are in the same region of the room as in EXAMPLE 1B, except now are toed-in.

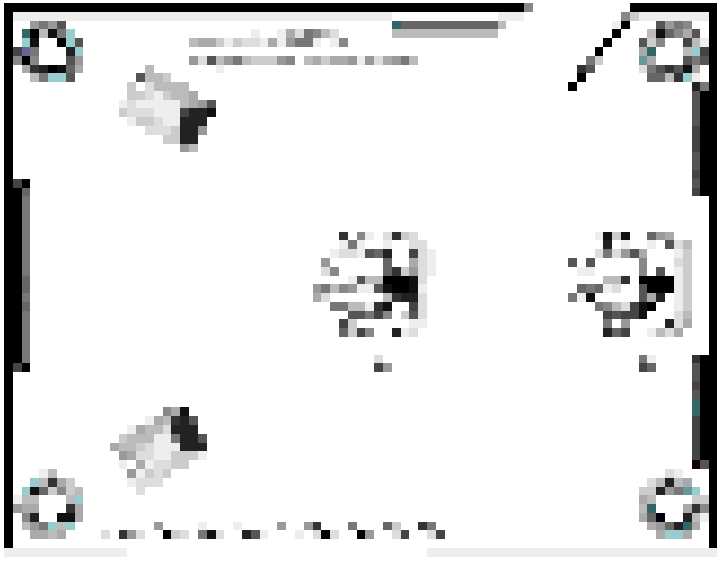
Figure 11

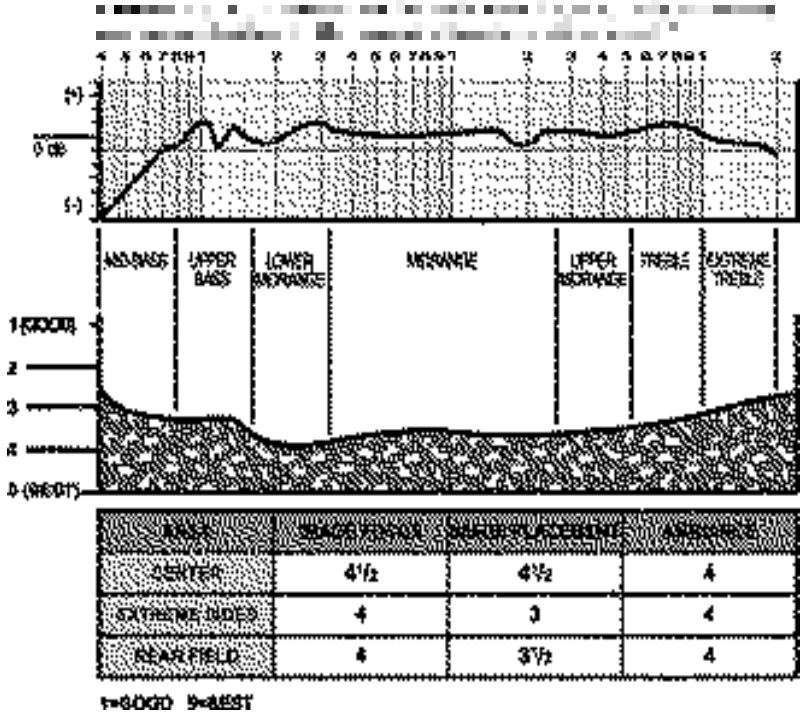
WATT- In room Placement, with toe, and Acoustical Treatment

Let us now go to figure 12, to see the benefits in performance which can be achieved by modest acoustical treatment of the room. With the speakers in the same location as in figure 11, we note the addition of tube traps in the corners of the listening room, as well as foam or Sonex panels placed between and behind the speakers, against the back wall, as well as along the wall behind the listener and over to the side next to the listener. The tube traps can be seen to smooth out the performance of the upper bass and lower midrange, while at the same time not compromising low frequency extension. Slap echo is controlled by the sound absorbing panel on the wall behind the speakers in the center of the sound stage and by the two panels on the back wall behind the listener. These two room treatments, namely tube traps and judicious placement of sound absorptive panels, can elevate the sonic performance of virtually any speaker system in a typical domestic listening room.

Should the listening position be as far from the speakers as possible, even up against a back wall? Figure 12, position B shows the effect of being seated near a back wall, some distance from the speaker. We can see a dramatic increase in upper bass and mid bass output of the system, actually due to standing wave reinforcement near the back wall, as well as the expected high frequency roll off resulting in the longer air path of the sound to the listener.

It should be noted that, in comparison to other speaker systems, even this compromised level of sound staging performance and resolution of low level detail still represents very good performance indeed.





BASS	REACTANCE	SHELF PLACEMENT	AMOUNT
CENTER	4½	4½	4
EXTREME SIDES	4	3	4
REAR FIELD	4	3½	4

1=GOOD 5=BEST

Figure 12

Speaker Placement vs. Listening Position

The location of your listening position is as important as the careful setup placement of your WATT/Puppy System 7 speakers in your room. The listening position should ideally be no more than 1.1 to 1.25 times the distance between the tweeters on each speaker. Therefore, in a long rectangular room of 12' x 18', if the speaker tweeters are going to be 9' apart, you should be sitting 9'11" to 11'3" from the speaker. This would be about halfway down the long axis of the room. Experiment carefully for best low frequency response.

Some people place the speakers on one end and sit at the other end of the room. Needless to say, this will not yield the finest sound. Carefully consider your listening position for optimal performance. Our experience has shown that any listening position which places your head closer than 14" to a room boundary will diminish the sonic results of your listening.

Choosing a Listening Position

Decide where you want your favorite listening position to be. Please remember that your WATT/Puppys can fill almost any room with the most beautiful sound. However, for the time aligning advantage, we want to ensure that you get all the benefits possible with the gruop delay adjustment features that are built into this design. For this purpose we ask you to consider the following questions:

What is the main purpose of your WATT/Puppys? Is it for a listening room dedicated to 2-channel audio? If yes, you should choose your position carefully to yield the finest sound. Wilson Audio uses a formula: The distance between the tweeters of the two channel times 1.2 equals the distance you should sit from each loudspeaker.

For instance, if you measure the distance between the center of the left channel tweeter to the corresponding right channel tweeter and it is equal to 10 feet, multiply it by 1.2. This means that you should sit approximately12 feet from each WATT/Puppy channel.

Are your WATT/Puppys dedicated for a home theater?

Are you going to sit on a couch, or will there be multiple rows of chairs?

If it is a couch, you should center the loudspeakers on the center position of the couch.

Multiple rows of chairs - In this case you should calculate the 1.2 times equation on your second row of seating. Now more people will enjoy the power of your WATT/Puppys.

Do you still want to listen to 2 channel music at its highest quality? In this way you can enjoy optimized sound from that second seat.

Speaker Orientation

Speaker placement and orientation are two of the most important considerations in obtaining superior sound. The first thing you need to do is minimize the influence of the side walls on the sound of your system. Speakers placed too close to the side walls will suffer from a strong primary reflection. This can cause out-of-phase cancellations, or comb filtering, which will cancel some frequencies and change the tonal balance of the music. A good place to start is with the speakers about 18" from each wall and, if you need to move them relative to the side wall, move them away from the wall, not closer.

A very important aspect of speaker placement is how far to place the speakers from the wall behind them. The closer to the back wall the more pronounced the low bass energy and centering of the image will be. However, this comes at a definite reduction in stage size and bloom, as well as a deterioration of upper bass quality. You must find the proper balance of these two factors, but remember, if you are partial to bass response or air and bloom, do not overcompensate your adjustments to maximize their effects. Overbalanced systems are sometimes pleasing in the short term, but long term satisfaction is always achieved through proper balance.

The WATT/Puppy System 7 is designed for maximum phase coherence and pulse replication accuracy when they are aimed directly at the listener or microphone. Thus, your WATT/Puppys should be "toed in." In other words, the listener, when seated in the listening position, should just barely see the surface of the inner side of the WATT/Puppy. Toeing in the speakers provides dramatic improvements in resolution of low level detail in the mid-range, as well as dramatic improvements in sound staging performance.

Summary

In summary, it is clear that, for optimal tonal balance accuracy, resolution of low level detail and sound staging performance, the WATT should be positioned at or slightly below ear level of the listener. The Puppy is the ideal compliment to the WATT, in that it establishes a correct height, is non-resonant, its high-pass crossover protects the WATT woofer, and response is extended to below 25Hz (see Figure 13 for WATT/Puppy response).

Ideally, the speakers should not be positioned too far from the listener, if maximum resolution of low level detail is required (near-field monitoring). If possible, the speakers should be positioned out into the room, slightly asymmetrically away from side and rear walls. The speakers should be toed-in toward the listener, preferably so that the listener at his seated position can barely see the surface of the inner side panel of the WATT as he faces the speaker. It is recommended that a distance of 2-3 feet, and possibly more, be maintained between the WATT and the rear walls and a distance of at least 1 1/2 feet be maintained between the front panel of the WATT and reflective side walls. Use of sound absorbent materials may reduce the space requirement somewhat. Experiment for each room.

By following the guidelines in this manual and your own common judgement, your new WATT/Puppy speakers will provide you with a lifetime of pure music reproduction.

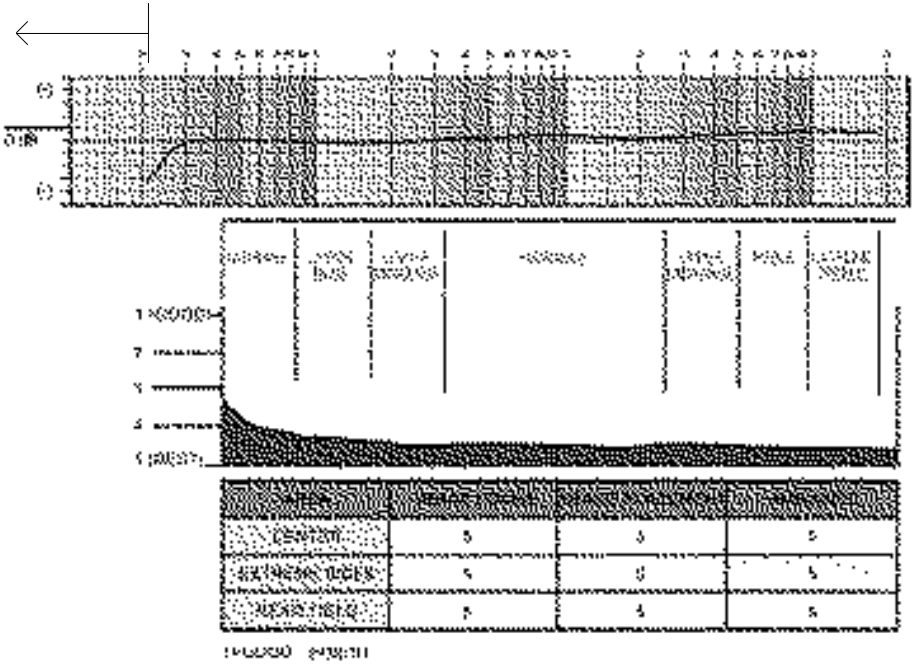


Figure 13

Note: Before setting up the Watt/Puppy System 7 study carefully the previous section on room acoustics. It provides valuable information on determing the ideal room location for your speakers.

PREPARATION

You will need the following items:

- Supplied hardware kit
- Tape measure
- Geometric timing charts (Appendix A)
- Known listening position

Take a moment to familiarize yourself with the top of the Puppy. It contains information that will be needed during the setup (see Figure 14 below).

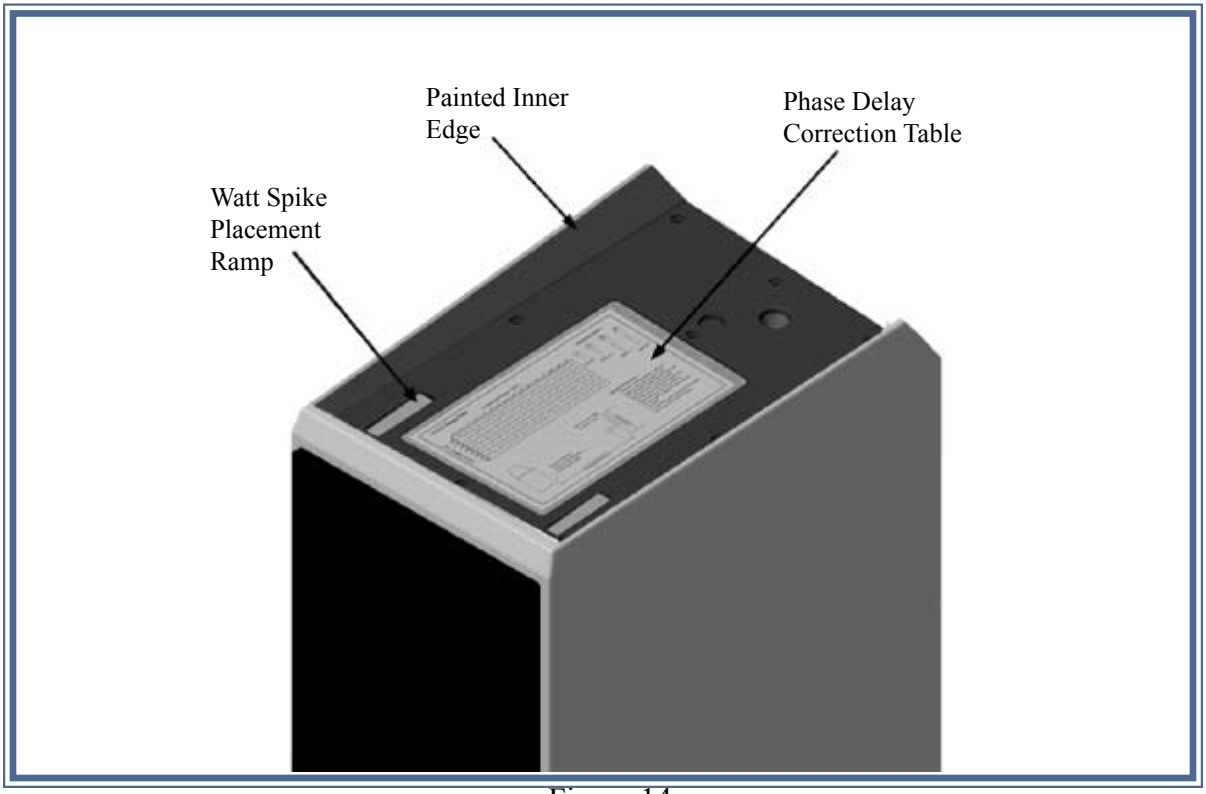


Figure 14

SETUP

- Place the Puppy enclosures into the selected room location (as determined by section 3)
- Determine your listening position
- Measure the listening distance and ear height (see example on Puppy top)
- Using the Phase Delay Correction Table select the required Alignment Spike
- Install the WATTs front spike until snug
- Install the Alignment Spike until snug

Note: If using any spacers with your Puppy Paws refer to Appendix A for correct alignment table

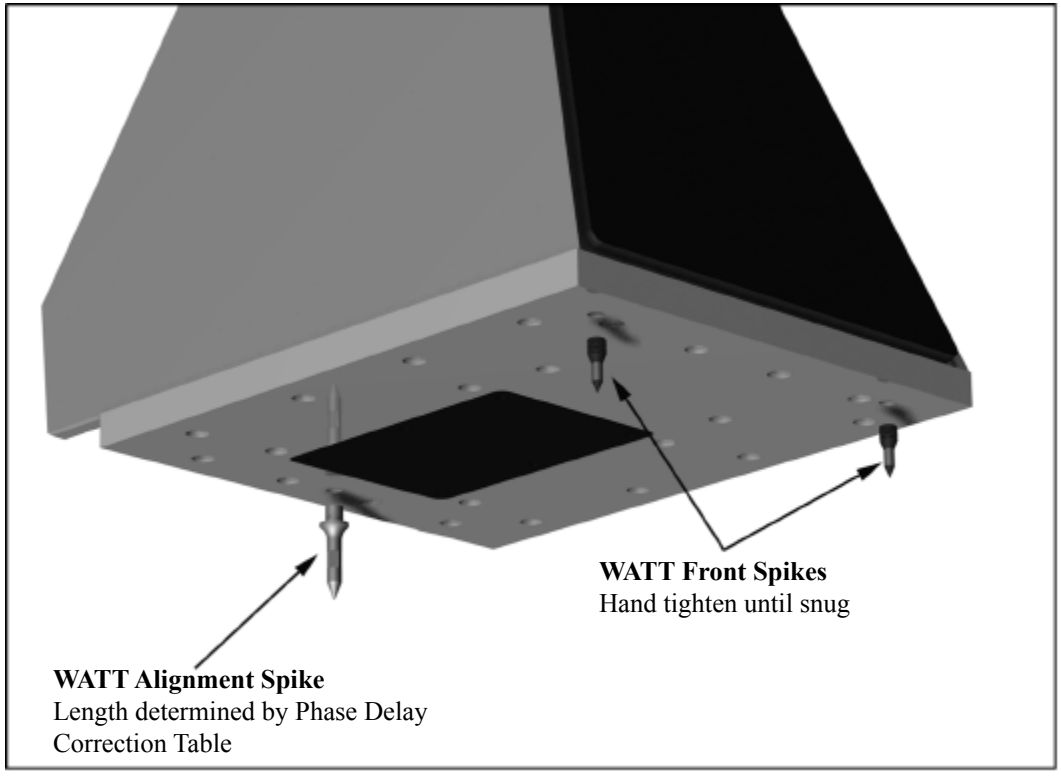


Figure 15

- Carefully, place WATT onto spike placement ramp on top of the Puppy about 3 inches from the front. *Be careful not to damage the lower edges of the Watt or Puppy top*

- Grasping the handle and top of WATT, slide the WATT forward until the spikes just slide off the ramp (see Figure 16 below)

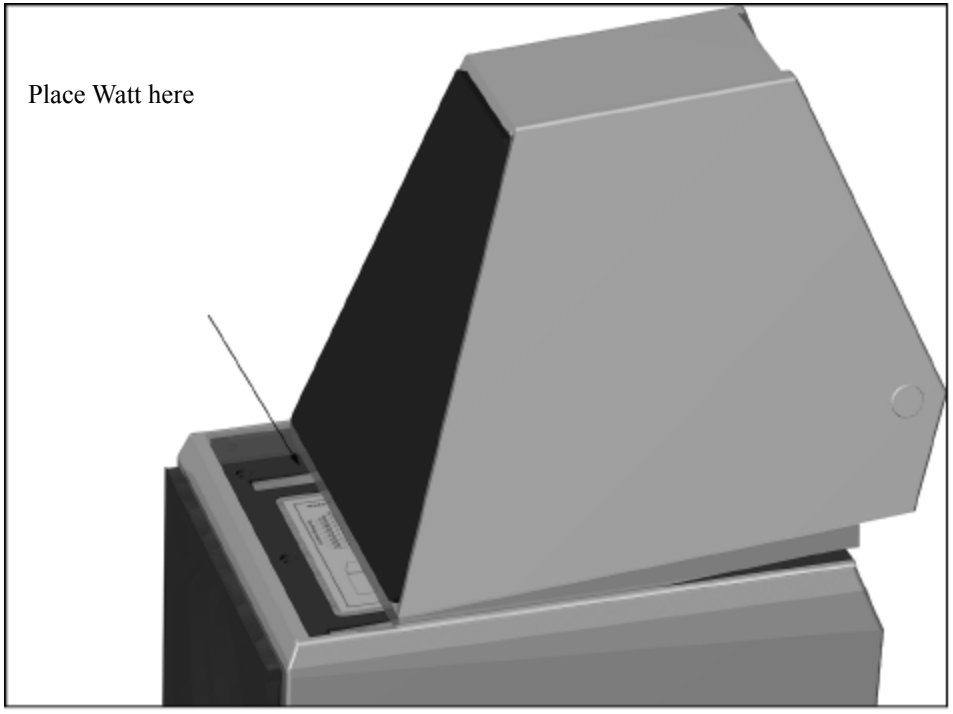


Figure 16

- Carefully, lower the rear of the WATT onto the decoupling plate
- Adjust the position of the WATT so it is centered on the Puppy
- Remove the protective film. To remove, just start at the edge and peel it off.

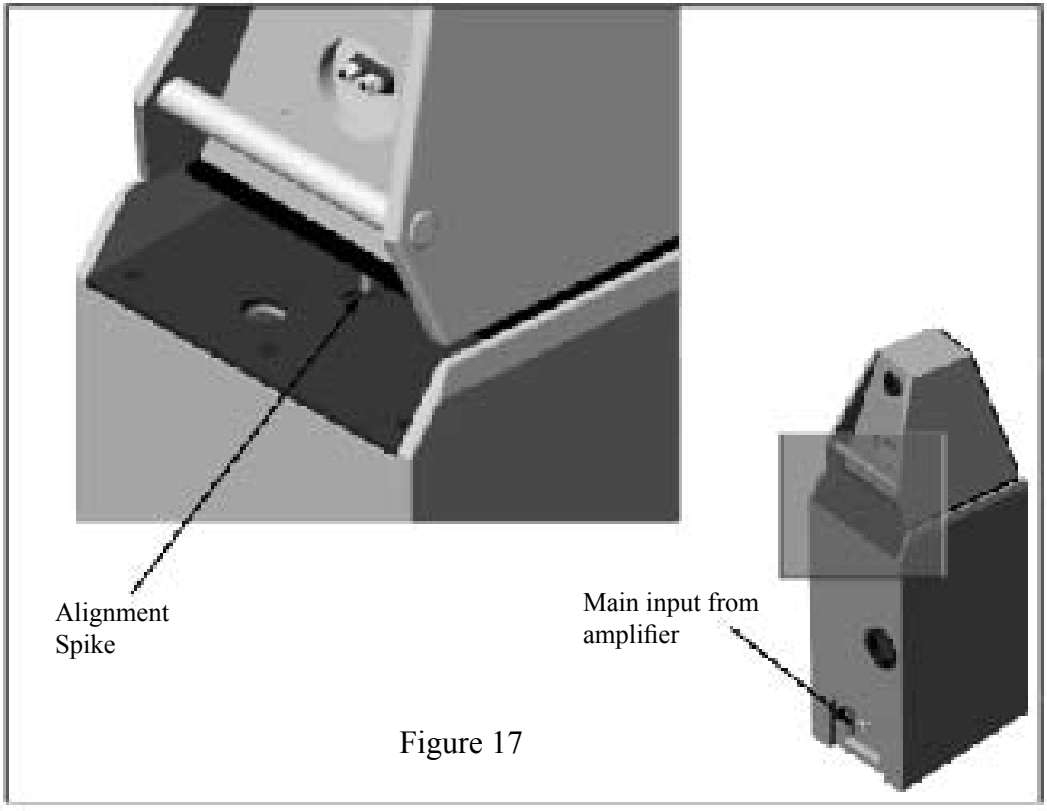


Figure 17

PUPPY TAIL CONNECTION

The correct connection of the Puppy Tail in the WATT/Puppy system 7 is:

- Connect the other RED lug at the load end of the tail to the RED terminal on the WATT.
- Connect the other BLACK lug at the load end of the tail to the BLACK terminal on the WATT.

Note: Please resist the temptation to invert the polarity of the Puppy Tail in the WATT/Puppy System 7. Such an inversion will produce entertaining ambient effects, but destroys the linearity and harmonic structure of the system.

Puppy Paws

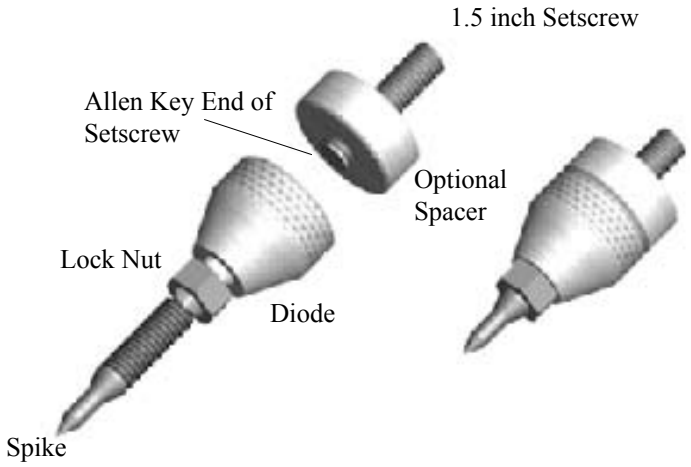
Included with your WATT/Puppy System 7 are two sets of Puppy Paws, which provide acoustical isolation as well as optimal height placement for your speakers. There are three ways of assembling the paws (without spacers, or with one or two spacers), and your choice will depend on your listening room and personal tastes. Wilson generally recommends no spacers, for simplicity and rigidity. However, the addition of spacers changes the driver-to-floor dimension, and can sometimes be used to reduce an objectionable upper-bass/lower mid-range standing wave.

Assembly:

1. Insert either the short or the long threaded bolt, depending on the desired height (see figure 18 next page) as far as it will go into the hole in the bottom of the Puppy. Make sure the Allen key end is accessable.
2. If desired, place the corresponding number of spacer discs over the bolt.
3. Screw the acoustical diode onto the bolt until it butts up against the spacers or Puppy bottom.
4. Screw the spike (with nut) all the way in until it just touches the bolt. Do not tighten the nut at this time.
5. Repeat steps 1 through 4 with the other three paws.
6. To provide the proper mechanical coupling between the Puppy Paws and the floor, make sure that the Puppy is level by unscrewing individual spikes as needed until even contact is achieved by all four Paws. A bubble level is often helpful in this procedure.
7. Once all adjustments have been made, tighten the nut on the spike to the diode with the 9⁄16" wrench provided. DO NOT OVERTIGHTEN! "Snug" is tight enough.

PUPPY PAWS
ASSEMBLY DIAGRAM

Option 1
(0-1 Spacers)



Option 2
(2 Spacers)

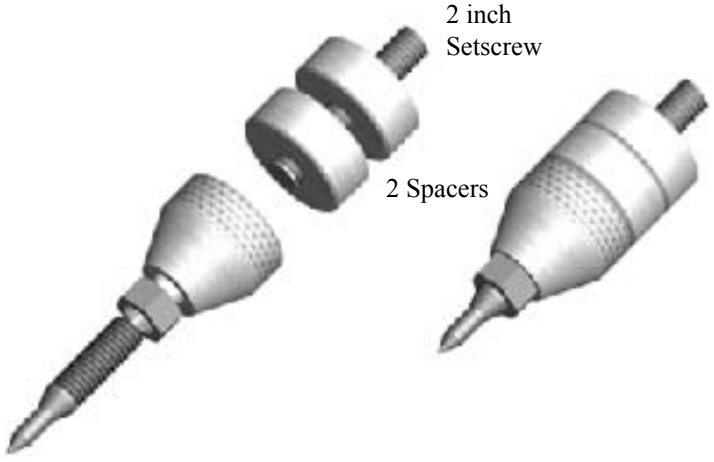


Figure 18

5

Table to be used when using no Puppy Spacers

Listening Distance (feet)

Ear Height (inches)	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
34	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
36	3	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
38	2	3	3	4	4	4	4	4	4	4	4	4	4	4	4	4
40	2	2	3	3	3	3	3	4	4	4	4	4	4	4	4	4
42	1	1	2	2	3	3	3	3	3	3	4	4	4	4	4	4
44	1	1	1	2	2	2	3	3	3	3	3	3	3	4	4	4
46	1	1	1	1	2	2	2	3	3	3	3	3	3	3	4	4
48	1	1	1	1	1	2	2	2	2	3	3	3	3	3	3	3

Table to be used when using 1 Puppy Spacers

Listening Distance (feet)

Ear Height (inches)	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
34	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
36	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
38	3	3	3	4	4	4	4	4	4	4	4	4	4	4	4	4
40	2	3	3	3	3	4	3	4	4	4	4	4	4	4	4	4
42	1	2	2	3	3	3	3	3	3	4	4	4	4	4	4	4
44	1	1	1	2	2	3	3	3	3	3	3	3	4	4	4	4
46	1	1	1	2	2	2	3	2	3	3	3	3	3	4	4	4
48	1	1	1	1	1	2	2	2	2	3	3	3	3	3	3	3

Table to be used when using 2 Puppy Spacers

Listening Distance (feet)

Ear Height (inches)	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
34	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
36	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
38	3	3	3	4	4	4	4	4	4	4	4	4	4	4	4	4
40	2	3	3	3	3	4	4	4	4	4	4	4	4	4	4	4
42	1	2	2	3	3	3	3	3	4	4	4	4	4	4	4	4
44	1	1	2	2	2	3	3	3	3	3	3	4	4	4	4	4
46	1	1	1	2	2	2	2	3	3	3	3	3	3	4	4	4
48	1	1	1	1	1	2	2	2	3	3	3	3	3	3	3	3