

DCS SB-15121 21" Premium Cinema Subwoofer

The new QSC DCS SB-15121 21" premium cinema subwoofer is specifically designed for theatres that require the best possible subwoofer performance with high output and low distortion down to the lowest audible frequencies and where the ultimate in performance and reliability is demanded.

The muscle behind the massive 21" low-frequency transducer is a 6" (153 mm) diameter voice coil in a vented, neodymium magnet structure that is designed to dissipate extreme amounts of heat and allow for excursion that is twice that of typical 18" transducers. Cool operation, even at high power levels, increases driver lifespan and decreases power compression. The large, ported enclosure ensures response to the lowest audible frequency for bass that you can not only hear, but also feel.

The SB-15121 is a unique product with no direct competitive equivalent. Premium cinemas can offer increased subwoofer performance to go along with enhanced seating and upscale concession items and achieve a distinctive level of performance compared to their competitors.

Target Applications

- Premiere Cinemas
- Large Format Cinemas
- Post Production Facilities including Dubbing Stages
- Private Screening Rooms
- Any application needing the best subwoofer performance
 - Low distortion
 - Deep and extended low-frequency response
 - Low-power compression and port noise
 - High reliability and long life

As with any premium product, achieving high levels of performance carries a higher price tag. The massive 21" driver features far more rugged construction than typical 18" drivers. The cabinet is also extensively braced. No cost has been spared to make the SB-15121 simply the best subwoofer available. There are less expensive options if typical subwoofers are good enough and the ultimate in performance is just not in the budget. However, the performance, quality and reliability of the SB-15121 is available for those special installations where only the best will do.



SB-15121 21" Driver



Typical 18" Driver

SB-15121 Advantages

The 21" woofer was designed with the most advanced measurement tools available to produce a rugged and nearly unbreakable transducer that is also capable of incredibly low distortion. Strength and finesse are combined in a truly state of the art component.

The massive cast aluminum frame not only provides the strength and rigidity needed for such a large driver but it also acts as a heat sink to keep the driver cool. Reduced thermal power compression means that large peaks are accurately reproduced and greater longevity comes from keeping glue and other components at safe operating temperatures.

The massive neodymium magnet structure produces a large and powerful magnetic field to ensure linearity at the highest cone excursion while maintaining good overall sensitivity.

The 6" (153 mm) diameter voice coil has a 50% greater circumference than the 4" (100 mm) voice coils found on most 18" drivers. The winding depth of 1.18" (30 mm) is 18% greater than the typical 1" (25 mm) deep coil, resulting in a surface area 77% larger than the typical 18" woofer voice coil. This provides greater heat dissipation for lower thermal power compression and almost total freedom from failure due to burned voice coils.

The rugged cone and suspension are optimized to produce a very linear compliance with smooth and extended travel in both the forward and reverse direction. These result in very low harmonic distortion and a driver that is virtually impossible to break with normal program material at any practical power level.

The linear throw of the 21" cone (X_{max}) is double that of a

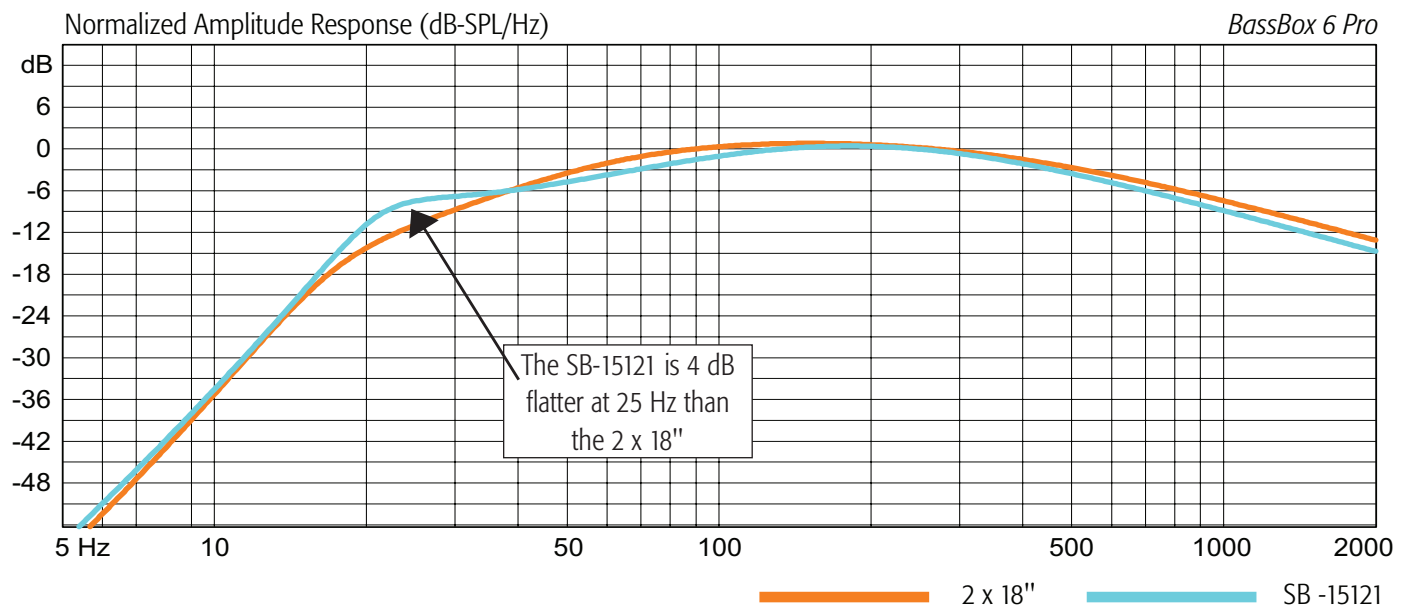
typical competitor's 18" woofer, 15 mm vs. 7.5 mm. When combined with the added surface area, this results in a volume displacement that is nearly equal to three typical 18" subwoofers. The SB-15121 displaces 2,520 cubic centimeters vs. 942 cubic centimeters for a typical competitor's 18" driver.

The extended low-frequency response of the SB-15121 is flatter than the natural response of most typical 2 x 18" cinema subwoofers. Therefore, the SB-15121 does not require a B6 boost filter to achieve a flat and extended low frequency response. A 6 dB boost at 25 Hz, used on most 2 x 18" subs, quickly consumes amplifier headroom and linear cone travel.

Computer Modeling of the SB-15121

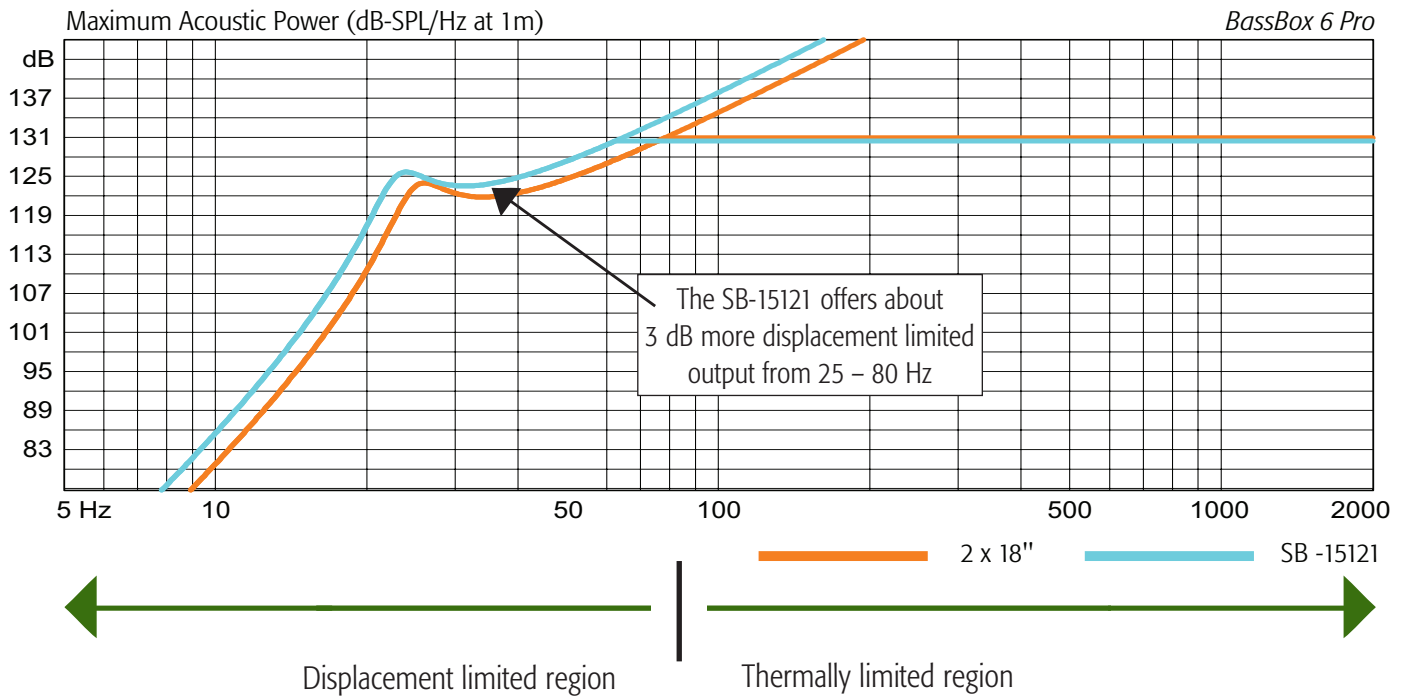
From 25 Hz – 100 Hz the SB-15121 response falls off by about 5 dB. A competitor's 2 x 18" subwoofer drops more than 10 dB over the same frequency range. The 2 x 18" subwoofer response is compensated for by using a boost filter to flatten the response, but a 6 dB boost increases amplifier power requirements by 400%.

Any comparison of the SB-15121 must be done after the SB-15121 and 2 x 18" sub are EQ'd to the same response curve. If the 2 x 18" sub is allowed to roll off naturally, its rising frequency response characteristic will make it sound louder than the flatter SB-15121 due to the increased output level in the upper end of the subwoofer frequency range. Typical 2 x 18" subwoofers will exhibit bottoming and other displacement-related problems well before the SB-15121 reaches its limits.

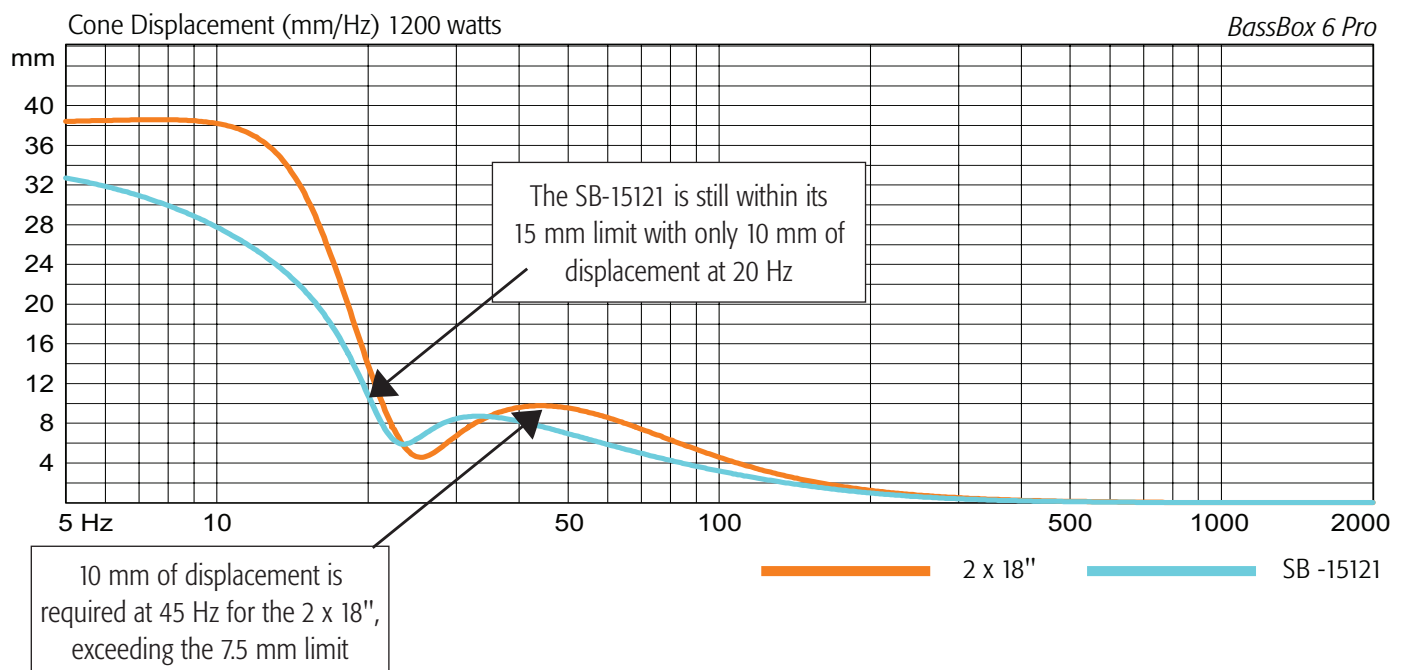


At subwoofer frequencies, the maximum output of most systems is limited by the distance the cone can move long before the thermal power limits are reached. Almost all published power specifications are thermal ratings and are not a good indicator of the maximum output levels that can be reached at subwoofer frequencies. This limit is called maximum displacement-limited output and it can be simulated during the design process.

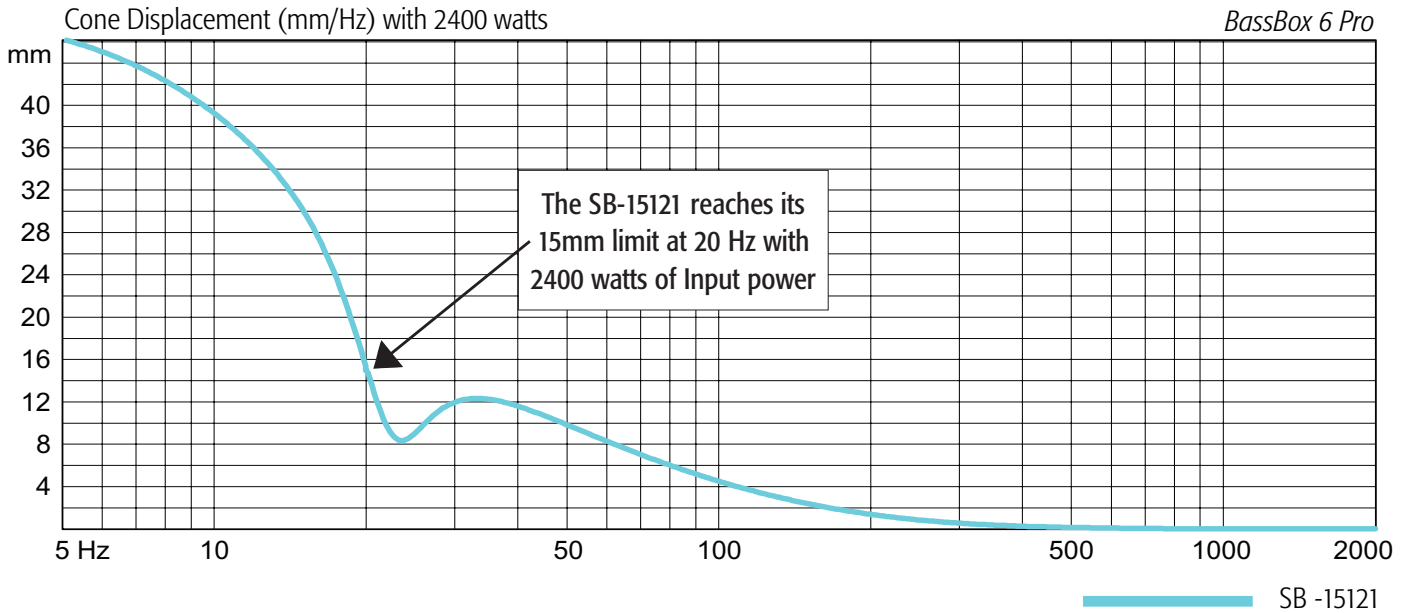
The displacement-limited output of the SB-15121 is 3 dB greater than a typical 2 x 18" sub in the critical 25 – 80 Hz region and is at least 6 dB greater at 20 Hz. A 3 dB represents an increase of twice the acoustic watts. Above 80 – 100 Hz, maximum output is thermally limited but this is not a limiting factor for most subwoofer systems.



At 1200 watts, the 2 x 18" sub has already exceeded its linear cone displacement limit by 2.5 mm at 45 Hz.

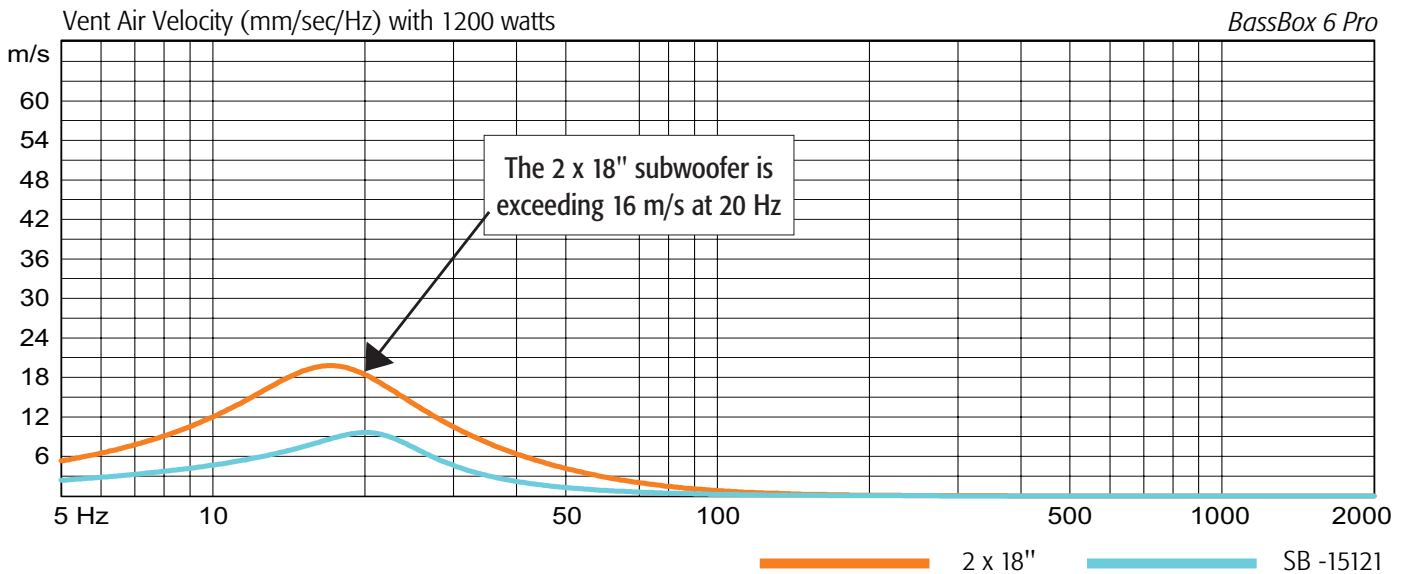


The SB-15121 finally reaches its full linear cone displacement limit of 15 mm at 20 Hz with an input of 2400 watts.

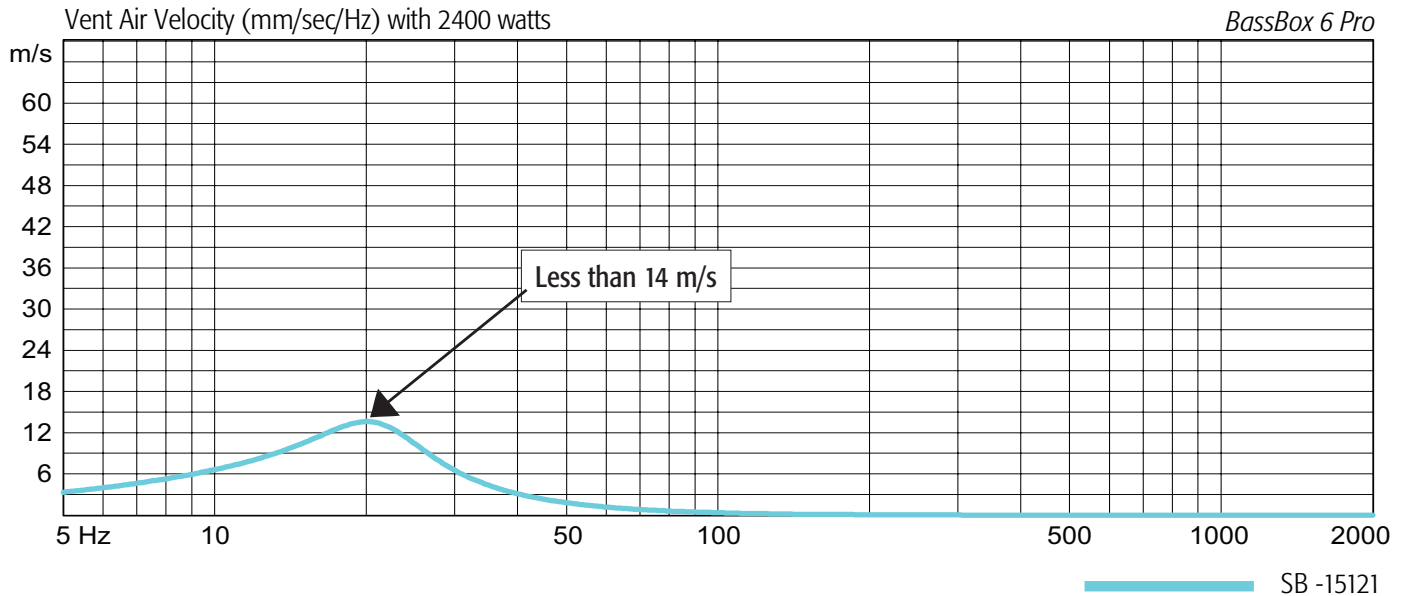


The massive ports of the SB-15121 produce very low vent air velocity, resulting in very quiet operation and reduced port power compression. It is desirable to keep port

velocity below 5% of the speed of sound or less than 16 m/s. At 1200 watts input, the SB-15121 easily meets this spec while the typical 2 x 18" subwoofer is at the limit.



The SB-15121 vent velocity remains below the 16 m/s goal all the way down to 20 Hz with an input of 2400 watts.



Placement of the SB-15121

As with all cinema subwoofers, the best performance will be obtained when the SB-15121 is installed at the floor/wall junction below the screen to achieve quarter-space loading. When multiple units are used, group the cabinets together for the best possible coupling and efficiency. Multiple subwoofers should always be grouped together as sensitivity goes up 3 dB for every doubling of the number of units. The most uniform coverage is usually obtained when the subwoofer array is slightly off-center but not too near side walls.

When possible, use a baffle wall behind the screen and flush mount the subwoofer in the baffle wall. This prevents reflections from the back wall from causing dips in the frequency response when the reflections cancel with the direct output from the front of the subwoofer.

Under quarter-space conditions the SB-15121 will have a sensitivity that is about 3 to 6 dB higher than the published half-space value of 99 dB. When calculating the number of required subwoofers, it is generally safe to assume about 102 dB 1w/1m for a single unit in quarter-space mounting.

Add 3 dB to the sensitivity for every doubling of the number of units for example, use 102 dB for 1 unit 105 dB for 2 units and 108 dB for 4 units. Total output also increases by an additional 3 dB for every doubling of units due to the increase in amplifier power.

Powering the SB-15121

Providing adequate power to fully utilize the performance of the SB-15121 is essential. One or two SB-15121 subwoofers should each be powered by a bridged DCA 2422 for most applications. A large array of 4 subwoofers can use 2 DCA 3422 amplifiers in stereo for all but the largest theatres since the gain in efficiency from the large array offsets the need for providing very high power.

Typical Subwoofer/Amplifier Combinations

The following chart is based on a target of 115 dB SPL at 2/3 of the way back in the auditorium under free field conditions. This results in a very conservative estimate of system performance that will meet SPL targets with low distortion and assure reliable, long-term operation.

Theatre Length	Number of SB-15121 Subwoofers	Power Amplifiers
Up to 40 ft (12 m)	1	1 x Bridged 2422
Up to 60 ft (18 m)	2	1 x DCA 3422
Up to 75 ft (22 m)	2	2 x Bridged 2422
Up to 100 ft (30 m)	3	3 x Bridged 2422
Up to 120 ft (36 m)	4	2 x DCA 3422

Always use a high-pass filter to prevent excessive cone excursion below 20 Hz. QSC recommends a 20 Hz high-pass filter with at least a 12 dB per octave slope (second order). This can be provided by the QSC DCP 300 Digital Cinema Processor, the DCM Digital Crossover Monitor, the SF-3 Subwoofer Filter or any QSCControl.net™ BASIS™ processor.

SB-15121 Comparisons

When comparing the SB-15121 to 2 x 18" subwoofers, the following precautions must be observed:

- Provide plenty of power to the SB-15121. It is slightly less sensitive than the typical 2 x 18" subwoofer at the upper end of the subwoofer frequency range and it is capable of far greater cone excursion. The SB-15121 will need more power to achieve maximum performance.
- Provide the correct high pass filters for each subwoofer and EQ them to have a similar response in the room.
 - The “tilt” of the B6 roll-off of typical 2 x 18" subwoofers will over-emphasize the upper subwoofer frequencies and make them sound louder than the flatter SB-15121 if the proper EQ is not used.
- After EQ, match the level of the subs.

When properly installed and powered, the SB-15121 will play louder and lower than systems using 2 x 18" subs. The SB-15121 excels when sustained high output levels with low distortion are required. Distortion, driver durability, port noise and power compression will all be improved with the SB-15121.

A Word of Caution

The SB-15121 is capable of reproducing very deep bass at very high levels. If your theatre wall construction does not provide adequate isolation with conventional subwoofers, your “bleed through” problems are likely to be even worse with the SB-15121.

Choose the auditorium location within a multiplex very carefully. Many complexes are laid out so that some auditoria have only one or even no shared walls. These are ideal locations for the SB-15121.

Conclusions

The SB-15121 is a premium cinema subwoofer. Proper application will result in outstanding subwoofer performance for cinemas, studios and large format theatres that demand the best possible performance.

The SB-15121 offers exhibitors a marketable competitive advantage. Cinema owners can highlight the massive 21" subs in their premium theatre advertising materials. This level of performance cannot be duplicated in the home theatre. Give patrons bass they can feel and they will tell their friends and keep coming back.



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