James B. Lansing Sound, Inc., 8500 Balboa Boulevard, Northridge, California 91329 U.S.A.

L250
PRODUCT DESIGN BRIEF

Author: John Eargle

Simply stated, the design brief for the L250 was to produce a loudspeaker system which combined with minimal compromise the attributes of:

1. Tonal accuracy
2. Transient accuracy
3. High dynamic range capability with low distortion
4. Accurate and stable stereophonic imaging

Let us define each of these attributes and tell you how we have arrived at them.

A. Tonal accuracy has to do with smoothness of the audio spectrum over its entire range. There are two aspects to it: on-axis response and power response. Flat on-axis response is important since the sound that arrives at our ears first determines the naturalness of instrumental timbres and provides essential stereo localization cues. Power response has to do with the total acoustical power radiated by the loudspeaker in all directions. Since most of the total sound arriving at our ears has been reflected at least once, it is important that the reflected sound power exhibit the same degree of smoothness we expect in the on-axis response.

JBL has arrived at tonal accuracy in the L250 through attention to the following design points:

1. Use of four transducers. The four drivers in the L250 are used only over that limited portion of their frequency ranges where they exhibit both flat on-axis and controlled power response.

2. Network characteristics. Response shaping is minimal, and the gentle, 6 dB/octave slopes at the transition frequencies further promote smooth power response.

3. Baffle configuration. The rounded edges and tapered shape of the enclosure minimize response peaks and dips due to diffraction, and this further improves on-axis and power response.

B. Transient accuracy is a measure of the loudspeaker's behavior in time. A steep waveform should arrive at the listener with all of its frequency components "in step." When this is not the case, then the sound may be described as "smeared", and subtle details will be lost. The relatively simple microphone techniques evident in many of today's audiophile recordings point up the importance of this attribute all the more.

JBL has arrived at transient accurancy in the L250 through attention to the following design points.

1. Network configuration. The gentle crossover slopes which favor smooth power response also exhibit minimum delay errors between drivers. Acoustical power output summation at each of the crossover points is nearly ideal.

2. Use of bypass capacitors. Borrowing from electronics design practice, polypropylene bridging capacitors are used throughout the main signal path to "linearize" the larger network capacitors. They are placed in parallel with the larger network capacitors, effectively equalizing the energy storage and energy discharge characteristics of the capacitors.

3. Tilting of the front baffle. Under some listening conditions the ear can detect timing errors less than one millisecond (one-thousandth of a second). In the L250, the tilting of the baffle corrects all on-axis timing errors to within 200 microseconds (millionths of a second). The acoustic centers of the drivers are thus aligned and provide ideal phase characteristics over a large listening arc.

C. High output capability with low distortion is essential if music is to be heard at levels approaching those of the original performance. This attribute becomes more important as digital technology enables us to preserve peak relationships in recordings. A playback system that will handle peaks some 12-to-15 dB above normal average listening levels is indeed a rare one. Not only are large amounts of power reserve needed, but the loudspeaker itself must be able to handle those peaks effortlessly and without dynamic compression, the tendency of many loudspeakers to "self limit" as their voice coils heat us.

JBL has addressed the goals of high output capability with low distortion in the following ways:

1. Ruggedized transducers. All the transducers in the L250 have cast frames for maintaining precise voice coil-magnetic gap geometry. The SFG (Symmetrical Field Geometry) magnetic structure of the lower two drivers allows high cone excursions with minimum distortion.

2. Low-loss dividing network. All reactive components have high current and voltage ratings; they can handle any expected power input without exhibiting non-linearities. All resistors are non-inductive wire-wound types, and network adjustments are all made by low-loss stepped attenuators made of massive "buss bar" stock, for high current "straight-wire" performance.

3. Enclosure construction and damping. The 3/4" particle board enclosure is generously braced, and all subchambers are sealed and critically damped.

4. High driver sensitivity. The drivers used in the L250 system are inherently of high sensitivity, which, in conjunction with their high power handling capability, allows extremely high output levels with generous headroom.

5. Low dynamic compression. All voice coils in the system are made of copper for minimum resistance increase at high drive levels.

D. A Note on Stereo Imaging.

When all system elements are designed with minimal compromise, the simple expedient of placing the drivers in a vertical, mirror-imaged array results in unambiguous and stable stereo imaging in both lateral and depth dimensions. Just as today's better audiophile records place greater demands on system power handling, the simple microphone techniques in favor today will yield a quality of imaging over the L250's many listeners may never have heard before.

System Characteristics:

Enclosure: Non-rectangular shape minimizes diffraction effects (minimum baffle width for each driver). Material: 3/4" particle board, heavily braced. Vent on rear panel chosen after experimentation for best results.

Network: Inductors: Air core except in bass section; bass inductor iron core; handles 10 amperes before saturation; chosen for low DC resistance and self-contained field.

Capacitors: All are 5 ampere, 200 volt or greater rating; capacitors in the main signal path are bypassed with polypropylene and/or polystyrene capacitors.

Resistors: Wire wound, non-inductive, 10-watt minimum rating.

Controls: Stepped buss-bar type attenuators.

Crossover frequencies: 400 Hz, 1.5 kHz and 5 kHz.

Crossover Slopes: 6 dB/octave.

High-frequency Driver: one-inch hard dome type. Copper coil for minimum resistance change under high drive. Dome is phenolic material, which resists breakup and distortion under high drive conditions. Compliance uses viscous damping by means of critical placement of front cover inner diameter relative to compliance. Flux density: 15.5 kilogauss.

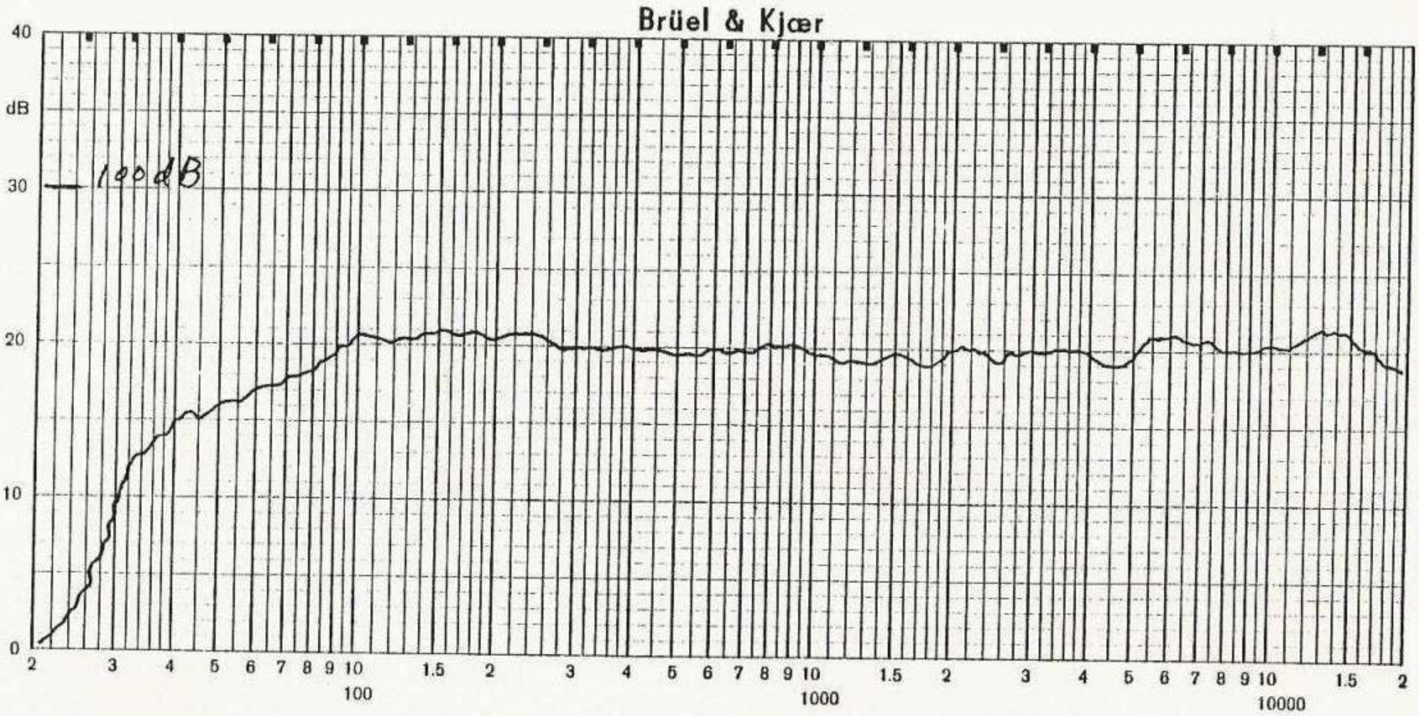
Upper Mid-range Driver: five-inch cone transducer. Copper coil for minimum resistance change under high drive. Sensitivity high (94 dB, 1W, 1m), so driver can be substantially padded, allowing for more headroom, dynamic range, and low distortion. Radiated power is constant to 6 kHz. Isolated in subchamber in enclosure.

Lower Mid-range Driver: Eight-inch cone transducer. Two-inch copper voice coil for minimum resistance change under high drive. Very flat amplitude response. Sensitivity 95 dB, 1 W, 1 m. 100-watt continuous sine wave power rating. Cone treated with Aquaplas for damping and breakup control. Magnetic structure utilizes Symmetrical Field Geometry (SFG).

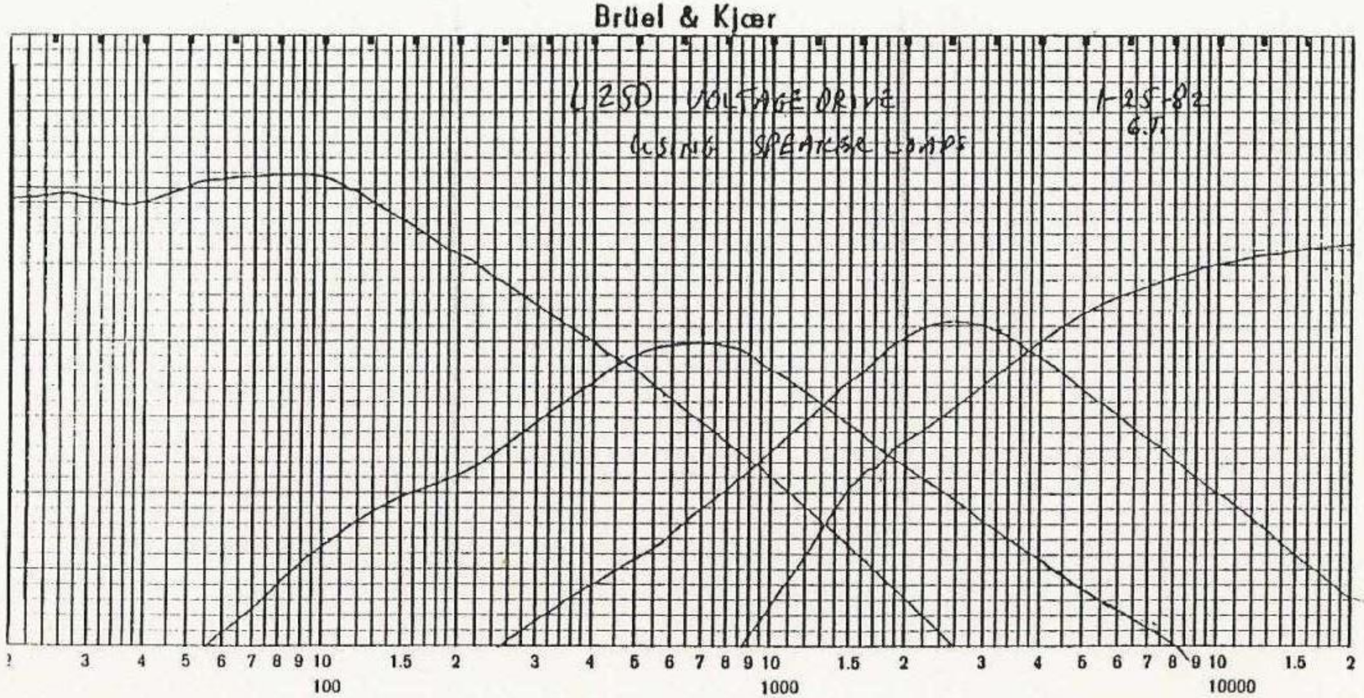
Low-frequency Driver: Fourteen-inch cone transducer. Four-inch copper ribbon wire voice coil for minimum resistance change under high drive levels. Cone treated with Aquaplas on both sides to control breakup and damp spurious vibrations. SFG magnetic structure. Suspension characteristics are matched to coil-gap dimensions so that suspension is linear while coil is within linear range of travel; when coil travel becomes non-linear, suspension becomes stiffer to retain control of cone travel. Aluminum voice coil support. 150-watt sine wave power rating. Mounted in 4 cubic foot vented enclosure.

L250 Frequency Response

1 watt at 2 meters, ground plane. In a typical listening room, response would be extended to 30 Hz.



L250 Dividing Network Response



L250
Technical Information

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3. Baffle configuration. The rounded edges and tapered shape of the enclosure minimize response peaks and dips due to diffraction, and this further improves on-axis and power response.

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2. Low-loss dividing network. All reactive components have high current and voltage ratings: they can handle any expected power input without exhibiting non-linearities. All resistors are non-inductive wire-wound types, and network adjustments are all made by low-loss stepped attenuators.

3. Enclosure construction and damping. The 3/4" particle board enclosure is generously braced, and all sub-chambers are sealed and critically damped.

4. High driver sensitivity. The upper and lower mid-range drivers have sensitivities at least twice that of the LF and HF drivers. This means that they are padded down relative to the LF and HF drivers, resulting in increased mid-range power handling and headroom.