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JBL L7 SPEAKER

Manufacturer's Specifications

System Type: Four-way, tower-style vented box.

Drivers: 12-in. cone woofer, 8-in. cone mid-bass, 5-in. cone mid-range, and 1-in. titanium-dome tweeter.

Frequency Response: 30 Hz to 27 kHz, ±6 dB.

Sensitivity: 91 dB at 1 meter with 1 watt applied.

Crossover Frequencies: 180 Hz, 900 Hz, and 4 kHz.

Nominal Impedance: 6 ohms.

Recommended Amplifier Power: 35 to 450 watts per channel.

Dimensions: 45 15/16 in. H × 9⅝ in. W × 17⅝ in. D (116.7 cm × 24.4 cm × 44.8 cm), excluding base; base mounts flush with front and rear of cabinet, increases height by 1 in., and extends 2½ in. on either side.

Weight: 75 lbs. (34.1 kg) each.

Price: $975 each ($1,950 per pair), including base; available only in black ash.

Company Address: 240 Crossways Park West, Woodbury, N.Y. 11797; (800) 336-4525.

For literature, circle No. 93

JBL's new L series consists of four models—the L1, L3, L5, and L7—which range from a small two-way 6-inch system to the L7 reviewed here, a floor-standing four-way 12-inch system. The L series is just below JBL's high-end XPL series of home loudspeakers.

The L designation in JBL's consumer line has long held an honorable position, going back to the early 1970s. In my JBL literature file (which is quite extensive, because I worked for the company's pro division for seven years beginning in the late '70s), I counted no fewer than 28 models with the venerable L prefix, running from the L15, to the very popular L100 "Century," and up to the mid/high-range horn-loaded L300.

The L7 is a true four-way, all direct-radiator loudspeaker and is only sold in mirror-image pairs. The bottom 2½ octaves are handled by a beefy long-throw 12-inch woofer mounted on the side of the cabinet and operating in a rear-ported box. The side-mounted woofer permits a relatively narrow cabinet just slightly wider than the 8-inch mid-bass driver. The mid-bass, mid-range, and tweeter drivers are in a vertical array on the top half of the cabinet, on a panel angled back about 9°. The cabinet's slanted top half minimizes internal standing waves because of the non-rectangular configu-

Titanium's high ratio of stiffness to mass raises the resonance of the L7's tweeter dome far above the audible range.

ration. JBL states that the L7's narrow cabinet and vertical driver array contribute to uniform and wide sound dispersion, which results in improved stereo imaging.

The cabinet is quite solidly constructed from a combination of both high-density and medium-density fiberboards, and it is well supported by side-to-side and front-to-back braces. The extensive bracing strengthens the side walls and reduces vibration. Lockmiter corners increase the rigidity of the cabinet.

Subchambers are used for both mid-bass and midrange drivers. All absorption materials are fiberglass, and connections are made with 16-gauge stranded wire. The rear-mounted plastic port is 4 inches in diameter and 8 inches long. A grille made of black cloth stretched over a curved plastic frame occupies the upper third of the cabinet's front. A recessed cloth-covered grille also covers the side-mounted woofer. The L7s are only available in a finish of black ash wood. A supplied plastic base increases the width of the speaker by 5 inches for increased lateral stability. No means are provided for attachment of spikes.

The system contains a new family of cast-frame drivers designed specifically for assembly on JBL's automated manufacturing line. The low-frequency drivers utilize JBL's Symmetrical Field Geometry magnetic design to minimize low-frequency distortion. The woofer and mid-bass drivers each have vented pole-pieces; holes in the rear of their magnet assemblies circulate air for increased heat dissipation. The tweeter contains a dome and surround made from pure titanium. Titanium has a very high stiffness-to-mass ratio, which raises the dome's resonance far above the audible range, but is extremely difficult to work with. JBL forms the dome with ribs and uses a proprietary diamond pattern for the surround. Titanium's high strength and rigidity are used to great advantage in JBL's tweeters.

The crossover of the L7 is constructed on two separate p.c. boards, one devoted to the woofer and the other to the mid-bass, midrange and tweeter. The double-banana-jack input terminals are connected by straps which can be removed for bi-wire operation, permitting the woofer to be driven separately from the rest of the system.

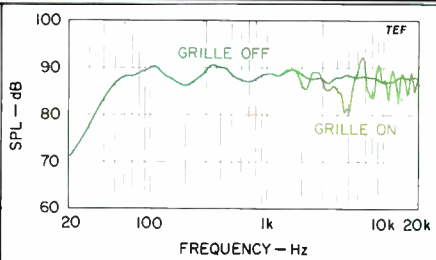

Fig. 1—Anechoic frequency response.

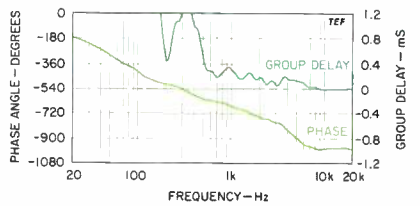

Fig. 2—Phase response and group delay.

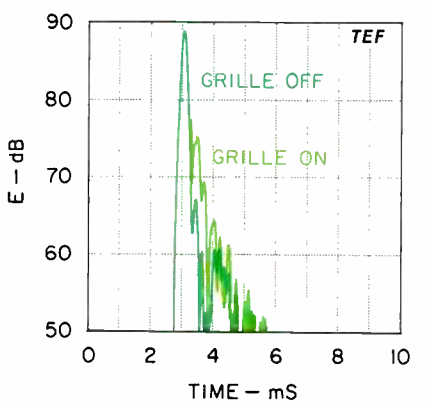

Fig. 3—Energy/time response.

The crossover is made up of 16 parts (not counting paralleled units): Four inductors, six capacitors, and six resistors. The crossover topology consists of a second-order low-pass section on the woofer, a first-order high-pass and a second-order low-pass section (forming a bandpass filter) on the mid-bass and midrange, and a second-order high-pass on the tweeter. All parts used in the crossover are of high quality, and all nonpolarized electrolytic capacitors are bypassed with low-value polypropylene units. The iron-core inductors in the woofer and mid-bass crossover legs are specified to have saturation currents higher than 4 amperes. JBL pays a lot of attention to the details, judging from the execution of the crossover, even to areas that consumers wouldn't normally see.

According to JBL's white paper describing the L series, the following performance characteristics were given high priority: Smooth on-axis response, smooth power response (i.e., smooth on- and off-axis response), accurate stereophonic imaging, and low distortion. The on-axis response should be smooth, because it defines the spectral balance of the sound that first arrives at the listener and so is of greatest subjective importance in judging timbre. Smooth power response is important because the room's sound and associated reverberation depend heavily on the off-axis response of the speaker and its power response. The total sound of a speaker depends not only on the direct sound reaching the listener but also on the later reflected sound. Assuming a properly designed listening room, a speaker with smooth on-axis and off-axis response will sound best. Accurate stereo imaging depends on absolute symmetry in your listening setup, on close right/left matching of the loudspeakers, and very uniform on- and off-axis horizontal response. Low distortion, particularly at high levels and low frequencies, is a requirement for realistic wide-range sound reproduction.

Measurements

Figure 1 shows the L7's on-axis anechoic frequency response. Measurements were taken at a distance of 2 meters from a point halfway between the midrange and tweeter and perpendicular to the front of the cabinet (not perpendicular to the tilted driver-mounting panel). A signal of 5.66 V rms was applied and the results referenced back to 1 meter. The response below 800 Hz was derived from 2-meter ground-plane measurements; the input was reduced to 2.83 V rms to compensate for the ground plane's 6-dB boost.

Overall, the response without the front grille fits a tight window of ±2.3 dB between 50 Hz and 20 kHz referenced to 1 kHz. Above 800 Hz, the

JBL gave high priority to smooth on-axis response, smooth power response, accurate stereo imaging, and low distortion.

response fits an even tighter window of ±1.4 dB. Above 20 kHz (not shown), the response was flat to 22 kHz and then rolled off rapidly at higher frequencies. Notably, the response above 20 kHz did not exhibit any of the high-Q dome resonances commonly exhibited by most metal-dome tweeters. The roll-off above 20 kHz was quite smooth and well behaved.

The only conspicuous features of the response occur below 800 Hz, where the curve in Fig. 1 exhibits an undulating character with peaks at 105 and about 350 Hz and adjacent troughs. The trough at 200 Hz roughly coincides with the crossover between the woofer and the 8-inch mid-bass. Separate ground-plane measurements of the L7's output energized through the bi-wire inputs (with the bi-wire straps removed) revealed that, indeed, the output was low in this region.

The front grille causes some fairly severe interference effects in the on-axis response. I suggest leaving it off for serious listening; the speaker looks quite acceptable without it.

Above 100 Hz, the right and left systems matched within a fairly close ±1.3 dB. Close right/left matching is a prerequisite for stable lateral imaging.

Figure 2 shows the phase and group-delay responses of the L7, referenced to the tweeter's arrival time. The phase rotates a consequential 280° between 1 and 20 kHz due to a combination of crossover design and the offset between the acoustic centers of the midrange and tweeter. Between 800 Hz and 4 kHz, the group delay of the midrange averages about 0.2 mS, which indicates that acoustically its output lags the tweeter with an equivalent distance of about 2.7 inches. The dip in the group delay at 200 Hz coincides with a dip in the axial response at about the same frequency, indicating a possible minimum-phase aberration. If the response were equalized flat in this region, the group delay would also be much smoother.

The L7's energy/time response is shown in Fig. 3. The test parameters were chosen to accentuate the response from 1 to 10 kHz, which includes the highest crossover region. With the grille off, the main arrival, at 3 mS, is quite slender and is followed by only a single prominent delayed arrival

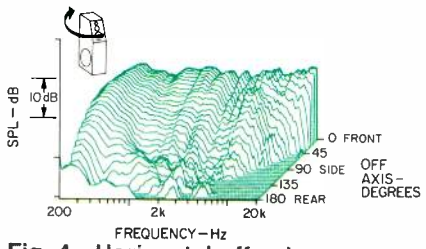

Fig. 4—Horizontal off-axis frequency responses.

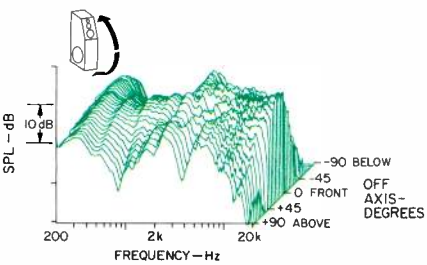

Fig. 5—Vertical off-axis frequency responses.

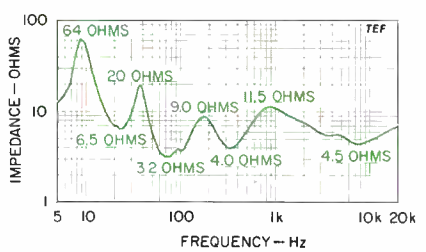

Fig. 6—Impedance.

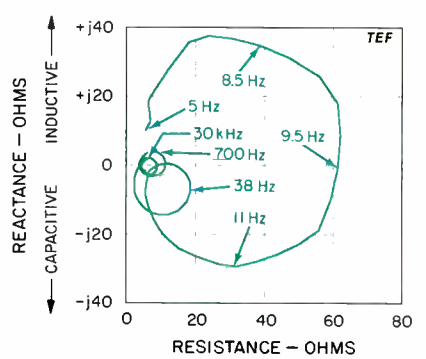

Fig. 7—Complex impedance.

about 23 dB down. With the grille, the main arrival is followed closely by three relatively high-level returns, the first only about 13 dB down from the main arrival.

The horizontal off-axis responses of the L7 are displayed in Fig. 4; the bold curve at the rear is the on-axis response. Because the on-axis response is carried over quite faithfully into the off-axis curves, the L7's horizontal coverage should be judged first-rate. Although the system is slightly asymmetrical, with the midrange and tweeter offset on the front panel, the off-axis responses to either side were essentially the same.

Figure 5 shows the vertical off-axis curves. The bold curve in the center of the graph (front to rear) is directly on axis. Not clearly seen is the excellent flatness of the curves in the main listening window, from 5° below axis to 15° above it. Only the 10° and 15° below-axis response curves exhibit interference in the upper crossover range (3 to 5 kHz), where relatively narrow dips of 10 to 15 dB are evident. At extreme angles off the axis and above it (front of graph), dips in the frequency response can be clearly seen at both of the upper crossover regions, 900 Hz and 4 kHz.

When the system was subjected to a high-level, low-frequency sine-wave sweep, no significant cabinet resonances were evident. A sharp minimum in woofer excursion occurred at 29 Hz, which indicates the L7's vented-box tuning. Even at levels above 30 V rms (150 watts) at the 29-Hz box resonance, wind noise from the port was quite low and the port's sound output was very clean. The woofer handled a robust 18 V rms (54 watts into 6 ohms) at frequencies below 20 Hz without producing any bad noises, and it did not exhibit any dynamic offset effects. The maximum excursion of the woofer was a healthy ¾ inch, peak to peak, with a linear excursion of about ½ inch, peak to peak, and the driver overloaded gracefully.

The L7's impedance magnitude is shown in Fig. 6. A minimum impedance of 3.2 ohms occurs at 70 Hz and a maximum of 64 ohms at the subsonic frequency of 9 Hz. The maximum impedance in the passband is 20 ohms at 40 Hz. Because the curve has a

The curves don't do justice to the excellent flatness of the response in the main listening window, from 5° below axis to 15° above it.

fairly high passband max/min variation of about 6.3:1, this speaker will be somewhat sensitive to cable resistance. Cable series resistance should therefore be limited to a maximum of about 0.044 ohm to keep cable-drop effects from causing response peaks and dips greater than 0.1 dB. For a standard run of about 10 feet, 14 gauge or larger wire should be used. Although smaller diameter wire, with higher series resistance, can be used, it will result in larger peak-to-dip response variations.

In Fig. 7 the complex impedance is plotted over the range from 5 Hz to 30 kHz with an expanded 80-ohm impedance scale. The large circle in the plot is the subsonic resonance of the lower vented-box impedance peak. The passband impedance phase (not shown) reached a maximum angle of +35° (inductive) at 550 Hz and a minimum angle of −71° (capacitive) at 48 Hz. The L7s will not be a problem for any high-quality amplifier, but don't parallel two L7s on one channel!

Figure 8 shows the 3-meter room curve with both raw and sixth-octave smoothed responses. The L7 was in the right-hand stereo position, aimed at the listening location; the test microphone was at ear height, at the listener's position on the sofa. The system was driven with a swept sine-wave signal of 2.83 V rms (1.33 watts into the rated 6-ohm load). The direct sound and 13 mS of the room's reverberation are included. Above 4 kHz, the smoothed curve is quite flat and extended. Some upper midrange emphasis between 1.5 and 2.5 kHz is noted. Excluding the two room-effect dips near 200 and 400 Hz, the curve fits an 8-dB window (±4 dB) from 100 Hz to 20 kHz.

Figures 9 and 10 show the single-frequency harmonic distortion versus power for the musical notes of E_1 (41.2 Hz) and A_2 (110 Hz). Distortion for the usual 440-Hz tone is not shown because the only distortion rising above the floor of my test gear consisted of about 0.2% third harmonic at full power. The power levels were computed using the L7's rated impedance of 6 ohms.

The E_1 (41.2-Hz) harmonic distortion data is shown in Fig. 9. At maximum power, the distortion only reaches

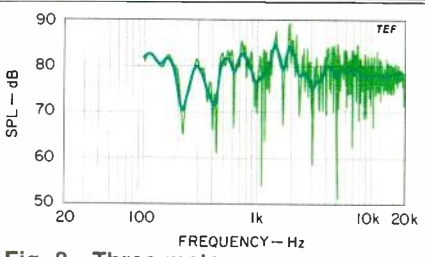

Fig. 8—Three-meter room response.

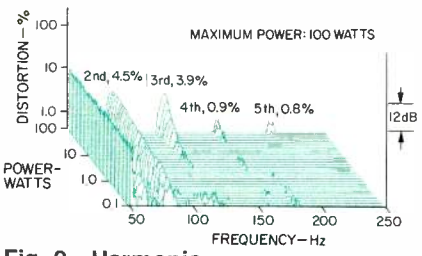

Fig. 9—Harmonic distortion products for E_1 (41.2 Hz).

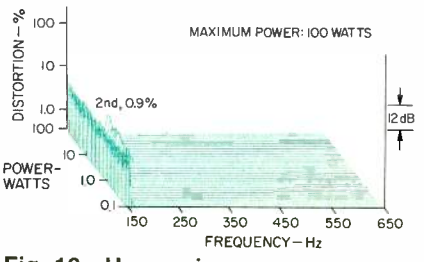

Fig. 10—Harmonic distortion products for A_2 (110 Hz).

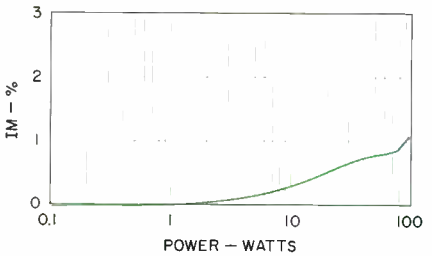

Fig. 11—IM for 440 Hz (A_4) and 41.2 Hz (E_1) mixed in equal proportion.

4.5% second and 3.9% third. Only small amounts of higher harmonics were evident. At 100 watts the L7 generates a fairly loud 104 dB SPL at 1 meter at 41.2 Hz.

The very low A_2 (110-Hz) distortion data is shown in Fig. 10. The second harmonic reaches only 0.9% at 100 watts; the higher harmonics were below the floor of my analyzer. At 110 Hz with a 100-watt input, the JBL generates a loud 108 dB SPL at 1 meter.

Figure 11 displays the IM distortion created by tones of 440 Hz (A_4) and 41.2 Hz (E_1) of equal input power. The IM rises only to the low level of about 1% at 100 watts. The four-way design of the L7, with a low crossover at about 200 Hz, separates the two IM test tones and sends one to the woofer and the other to the mid-bass driver, thus minimizing the distortion.

The L7's short-term peak-power input and output capabilities are shown in Fig. 12, and assume the rated 6-ohm impedance. The input power starts quite high, 230 watts at 20 Hz, but then fluctuates as frequency increases. Power-limitation dips occur at 60 Hz, 350 Hz, and 5.5 kHz. A maximum input of about 4.5 kW is reached between 800 Hz and 3 kHz and above 8 kHz.

In the vicinity of 60 Hz, the input power was limited to about 400 watts by a buzzing sound from the woofer. Both speakers exhibited the same effect. The power at 350 Hz was limited to about 900 watts; the output wave shape changed to a triangle, presumably due to crossover inductor saturation. Waveform distortion near 5.5 kHz limited the input power to about 1,000 watts. The flattening of the wave shape in this band may possibly have been due to tweeter excursion limitations in the bottom of its range.

The top curves in Fig. 12 show the peak sound levels the L7 can generate. The "room gain" of a typical listening room adds about 3 dB to the response at 80 Hz and 9 dB at 20 Hz.

The peak acoustic output rises rapidly with frequency up to 150 Hz, hesitates, and then reaches a peak at 1.6 kHz near 125 dB SPL. At higher frequencies, the output curve mimics the input-power curve's dip at 5.5 kHz. With room gain, the output exceeds 110 dB above 26 Hz and 120 dB above 90 Hz, with only a slight fall

The JBL L7's sound was well balanced, somewhat up-front, with extended frequency response and excellent dynamics.

below 120 dB between 200 and 300 Hz. Even with the limitations in input power noted earlier, the L7's low-frequency output can keep up with that of the best speaker systems I have tested as well as with several subwoofers I know about. A stereo pair of L7s can reach even higher low-frequency levels with bass material that's common to both channels.

Use and Listening Tests

Although the L7s weigh 75 pounds apiece, they were fairly easy for me to move around. They can be "walked" easily by rocking the cabinet from side to side. Even without their bases attached, these systems are quite impervious to sideways tipping motions. The molded base attaches to the bottom of the enclosure with eight Phillips-head screws. Unfortunately, JBL did not provide guide holes to help with screw insertion and alignment of the base. I would have preferred bolts and Tee nuts rather than just wood screws that are simply driven into the cabinet's fiberboard bottom. As noted, no provision is made for spikes on the bottom of the enclosure.

The L7s are quite handsome in their basic black finish. The cosmetics and fit and finish of the cabinets are excellent; even the drivers look first-rate when removed from the cabinet. No trim rings are used around the drivers, because they look superb on their own.

Connection to the L7s is through a pair of quite accessible double-banana jacks on the bottom rear of the cabinet. As stated, bi-wire capabilty is supported by a set of removable straps that connect the two sets of jacks. The banana jacks unfortunately cannot handle large-diameter bare wire. On my review samples, the red banana terminals had a larger hole than the black terminals.

The owner's manual for JBL's L series of speakers was quite informative, providing much detail on system placement, hookup, and operation. The manual also included a four-page supplement specifically for the L7, which covered in detail such topics as placement, bi-wiring, and biamping. Even though the L7 is not in JBL's high-end line, the supplement tackles what are essentially high-end issues. Several bi-wire configurations are discussed, ranging from a single stereo amp setup to the use of four mono amps (which may include a mixture of tube amps for high frequencies and solid-state amps for the low frequencies!). For simplicity, however, I did most of my listening in the straight (non-bi-wire) configuration.

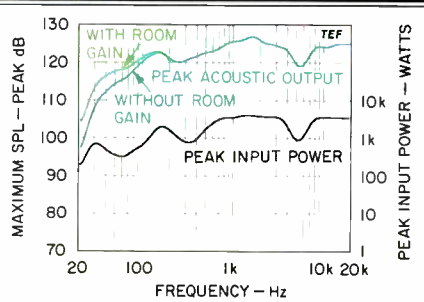

Fig. 12—Maximum peak input power and sound output.

Listening was done using Straight Wire Maestro cables hooked to a Bryston 4B power amp and .4B preamp, driven by Onkyo and Rotel CD players. JBL recommends placing the L7s 3 feet away from both the side and rear walls and with the side-mounted woofers facing each other. I was not able to follow the recommendation for equidistant placement (and didn't want to, either!). Instead, I placed the speakers further from the rear wall than the side walls, with the woofers facing inward. The speakers were essentially aimed at my listening position, separated by 8 feet, and about 10 feet away.

The JBLs spent some extra time in my listening setup because of scheduling mix-ups, and I very much enjoyed the extra exposure to them. These speakers demonstrated a well-balanced, somewhat up-front sound with an extended frequency response and excellent dynamics. Their reproduction of high-frequency percussive sounds was extended and smooth, easily the equal of my reference B & W 801 Matrix 2 systems.

Reproduction of organ pedal notes played by Michael Murray on *A Recital of Works by Bach, Messiaen, Dupré, Widor, and Franck* (Telarc CD-80097) was quite extended and clean. I did notice some slight coloration in the middle and upper midrange that gave the pipe organ a somewhat up-front signature. This characteristic was also evident on other classical music and on jazz.

On difficult vocal, instrument, and percussion material—such as 16th-century Spanish compositions by Mateo Flecha el Viejo on *Las Ensaladas: Burlesques of the Spanish Renaissance* (Sony Classical SK 46699)—the L7s exhibited a well-integrated soundstage with particularly good stereo focus and clean vocal and transient reproduction.

The L7s' evenness of vertical coverage was not quite as good as that of my reference speakers on the stand-up/sit-down test with pink noise. Some midrange and upper midrange tonal changes were noted. The L7s' sensitivity was somewhat higher than that of my reference systems. On some third-octave band-limited low-frequency pink noise, the L7s' output at 25 Hz and above actually exceeded my reference speakers' capability. For the 20-Hz band, the L7s' fundamental output was not as great as my reference systems'. For the 20-, 25-, and 32-Hz bands, the wind noise from the JBL's vent was significantly less than from the B & W's, helped by the fact that the JBL's vent faces the rear.

On *The Mambo Kings* soundtrack album (Elektra 61240-2), the JBLs' high-level performance on the Latin-flavored big-band material with heavy percussion was excellent. The two vocal tracks of Linda Ronstadt were rendered very realistically, with natural dynamics. On rock kick drum, the L7s kicked quite well, compressing only slightly at very high levels.

At $1,950 per pair, the L7s offer a very good combination of attractive styling, a well balanced and fairly neutral sound, excellent dynamics, and extended frequency response—coupled with the legendary JBL name. Give them a listen! *D. B. Keele, Jr.*