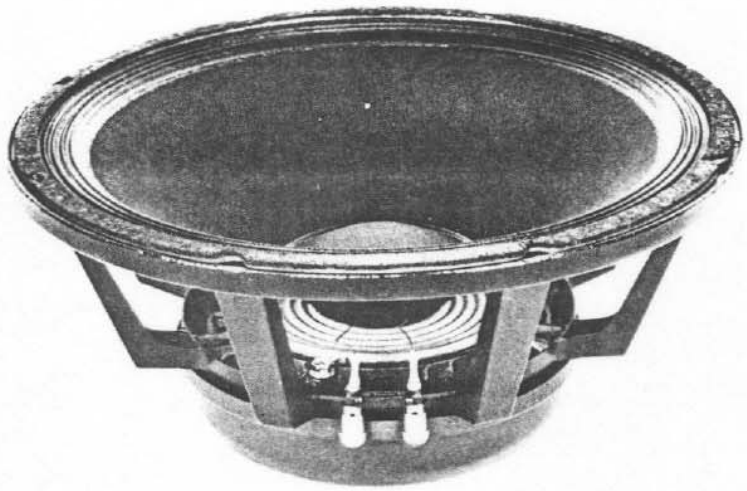
Electro-Voice®

DL15X

Low-Frequency Reproducer



- Woofer for two-way speech and music systems
- High excursion for low-frequency clarity and punch
- TIR™ & FDD™ reduce distortion, keep voice coil cool, and smooth frequency response
- 400 watts long-term power capacity
- 101-dB sensitivity
- Thermally efficient magnet assembly for high reliability
- PROTEF™ coating helps protect woofer from excessive power peaks

SPECIFICATIONS

Usable Axial Frequency Response in Typical Enclosure (4.0 ft³ tuned to 40 Hz), Swept One-Third-Octave Pink Noise, 4 Volts at 10 Feet, Anechoic Environment, Normalized for 1 Watt/1 Meter (see Figure 1):[1]
45-3,000 Hz

Power Handling (see Power-Handling Test section),
Per ANSI/EIA RS-426-A 1980:
400 watts
Per AES2-1984/ANSI S4.26-1984,
50-500 Hz: 400 watts
100-1,000 Hz: 500 watts

Sensitivity (SPL at 1 m, 1 watt input power, nominal impedance),
200- to 3,000-Hz Average:
101 dB
100- to 800-Hz Average:
98 dB

Impedance Response (see Figure 4 for response in typical enclosure; see Figure 3 for response in standard baffle),
Minimum (Z_{min}):
6.5 ohms at 230 Hz
Nominal:
8 ohms

Distortion Response (on axis in standard baffle, 10% rated input power; see Figure 5),
Second Harmonic,
100 Hz: –21 dB (8.9%)
1,000 Hz: –38 dB (1.3%)
Third Harmonic,
100 Hz: –31 dB (2.8%)
1,000 Hz: –40 dB (1.0%)

Beamwidth (angle included by 6-dB-down points on polar responses for octave bands of pink noise; see Figure 6),
500 Hz: 80°
1,000 Hz: 80°
2,000 Hz: 60°

1. For swept-sine-wave response in standard baffle, per AES2-1984/ANSI S4.26-1984, see Figure 2.

Physical Constants,
Effective Piston Diameter:
330.0 mm (13.0 in.)
Moving Mass (M_{MD}):
0.062 kg (0.137 lb)
Voice-Coil Winding Depth:
15.2 mm (0.6 in.)
Voice-Coil Diameter:
63.5 mm (2.5 in.)
Voice-Coil Winding Length:
18.1 m (59.4 ft)
Top Plate Thickness at Voice Coil:
10.9 mm (0.43 in.)
BL Factor:
20 tesla meter

Thiele-Small Parameters (broken in),
f_s: 42.0 Hz
V_{AS}: 195 liters (6.89 ft³)
Q_{ES}: 0.30
Q_{MS}: 4.55
Q_{TS}: 0.28
R_E: 6.0 ohms
η_0: 4.63%
S_D: 0.086 m² (132 in.²)
M_{MD}: 0.062 kg (0.137 lb)
L_E: 1.6 mH
C_{MS}: 0.19 mm/N
R_{MS}: 4.43 mechanical ohms
P_E(max) (per ANSI/EIA RS-426-A 1980):
400 watts
X_{max}[2]: 4.1 mm (0.16 in.)
X_{lim}[3]: 12.7 mm (0.50 in.)
V_D (S_D x X_{max}): 3.53 liters (0.012 ft³)

Thermal Rise after Power Test:
82 °C (180 °F)

Typical Vented Enclosures (see Typical Enclosures section):
4.0 ft³ tuned to 40 Hz or 6.0 ft³ tuned to 35 Hz

2. X_{max} is the one-way peak excursion which produces 10% THD of the current waveform when driven at f_s.
3. Displacement limit is the one-way peak excursion which, when exceeded, will cause physical damage to the drive mechanism.

Typical Amplifier Size (see Typical Amplifier Size section):
400-800 watts

Mounting Information (see Mounting section),
Bolt-Hole Diameter (eight evenly spaced holes):
7.1 mm (0.28 in.)
Bolt Circle Diameter:
371 mm (14.60 in.)
Baffle Opening Diameter (front or rear mounting):
353 mm (13.90 in.)

Electrical Connections (see Electrical Connectors section),
Connector Type:
Push terminals for bare wires
Polarity:
A positive voltage applied to the positive (red) terminal produces a positive pressure at the front of the cone

Additional Descriptive Information,
Magnet Weight:
2.2 kg (4.9 lb)
Magnet Material:
Barium ferrite
Frame:
Cast aluminum
Frame Finish:
Textured black epoxy
Plating of Steel Parts:
Bright Cadmium
Voice-Coil Material:
Aluminum
Voice-Coil Insulation:
Polyimide 220 °C rating
Voice-Coil Form:
Polyimide
Back Cover:
Black, advanced synthetic elastomer

Optional Accessories:
SMH-1 mounting hardware kit

DL15X SPECIFICATION GRAPHICS

FIGURE 1 — Axial Response in Typical Enclosure (4.0 ft³), 1 Watt/1 Meter

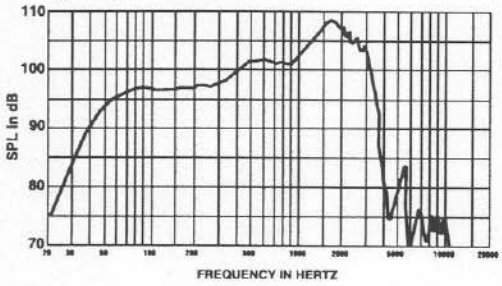


FIGURE 2 — Frequency Response in Standard Baffle (0° and 45°)

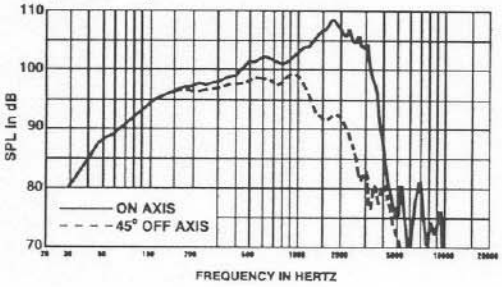


FIGURE 3 — Impedance in Standard Baffle

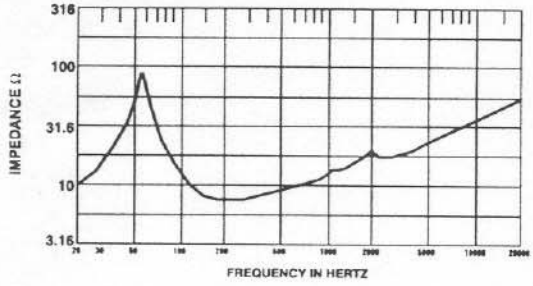


FIGURE 4 — Impedance in Typical Enclosure (4.0 ft³)

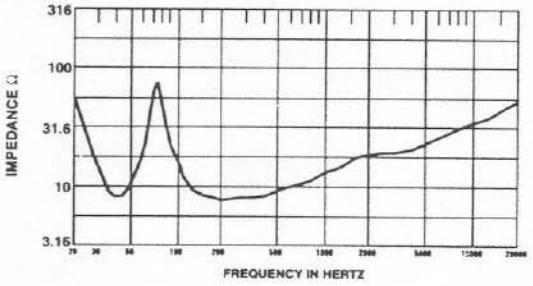


FIGURE 5 — Dimensions

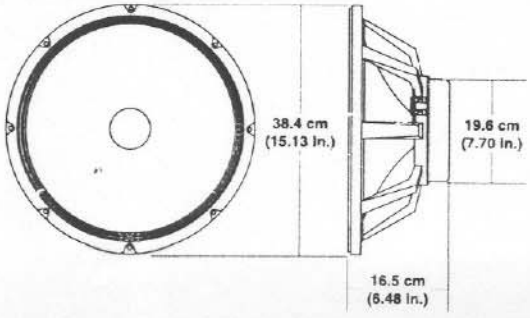


FIGURE 6 — Distortion in Standard Baffle at 10% Rated Input Power

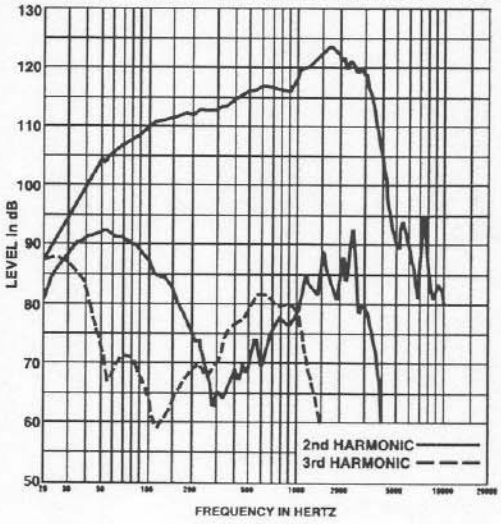


FIGURE 7 — Beamwidth vs. Frequency

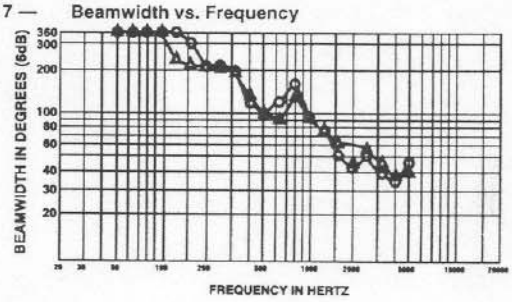


FIGURE 8 — Directivity vs. Frequency

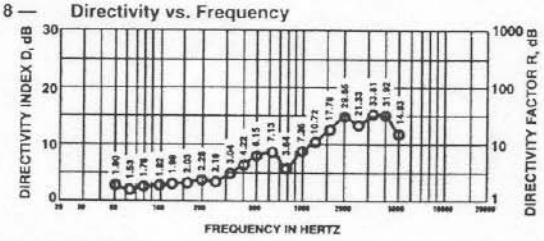


FIGURE 9 — Polar Response

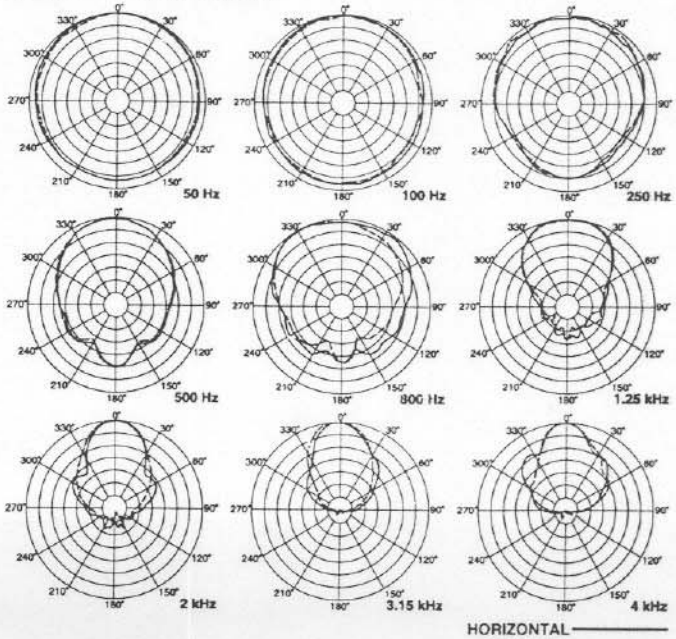


FIGURE 10A — Predicted Low-Frequency Response in a Typical Enclosure (4.0 ft³ tuned to 35 Hz)

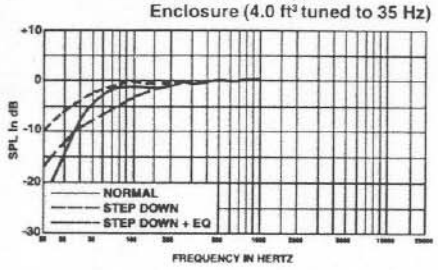


FIGURE 10B — Predicted Low-Frequency Response in a Typical Enclosure (6.0 ft³ tuned to 30 Hz)

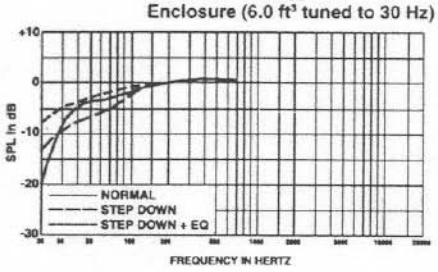
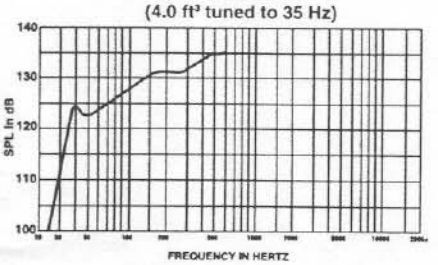


FIGURE 11 — Maximum SPL at 1 Meter in Typical Enclosure (4.0 ft³ tuned to 35 Hz)



Dimensions (see Figure 10),
Outer Diameter:
384 mm (15.13 in.)
Overall Depth:
165 mm (6.48 in.)
Net Weight:
8.6 kg (19.0 lb)
Shipping Weight:
10.2 kg (22.5 lb)

DESCRIPTION

The DL15X low/mid-frequency reproducer is a 15-inch, 8-ohm driver designed for professional high-level, high-fidelity monitoring and sound reinforcement. At the heart of this speaker is a carefully engineered drive system. Its design assures linear, low-distortion output, high power capability and efficient heat transfer.

Incorporated into the design are three exclusive Electro-Voice innovations. PROTEF™ coating (U.S. patent #4,547,632), a Teflon®-based coating, is applied to the inside diameter of the top plate.[4] Occasional violent power peaks of several seconds may expand a transducer's voice coil into contact with the top plate, causing failure. PROTEF provides protection against such failure. The coating lubricates any rubbing contact and provides electrical insulation between the coil and the steel top plate. The Thermo Inductive Ring (TIR™) and Flux Demodulation Device (FDD™), also included in the DL15X design, are aluminum castings fastened to the pole of the magnet. They provide a shorted turn to control inductance and provide a major heat transfer path from the voice coil, which improves power handling and reduces thermal dynamic-range compression.

The voice coil itself is constructed of edge-wound rectangular aluminum wire, mounted on a rugged, laminated polyimide former. The complete assembly is low in mass and is fabricated using the most advanced epoxies, insulations and materials available.

Great care was taken in the selection of diaphragm materials and construction to ensure smooth, musical upper-bass reproduction and accurate low-frequency shock capability (punch). The cone has a moisture-repellent treatment, allowing it to be used in harsh and humid conditions. (Do not expose the cone to direct water or sunlight.)

The DL15X is a true high-fidelity woofer in every sense, being capable of high output, low distortion and solid bass response.

DIRECTIONAL CHARACTERISTICS

The directional characteristics of the DL15X in a 4.0-cubic-foot vented enclosure were measured in Electro-Voice's large anechoic chamber. The test signal was one-third-octave filtered pink noise centered at the frequencies indicated. A full spherical measurement system, which is completely compatible with the AcoustaCADD™ computer-aided design program, was used. All directional information was measured at 20 feet. Figure 8 illustrates the horizontal and vertical polar responses. Figure 6 shows the horizontal and vertical beamwidths. Beamwidth is the angle at which the horizontal and vertical polar responses have decreased in level by 6 dB when compared to the axial frequency response. Figure 7 illustrates the total directivity of the DL15X. The directivity factor R_θ (Q) is the relative value, at a point, of the DL15X when compared to an ideal spherical response. The directivity index, D_i, is calculated by the formula: $D_i = 10 \log_{10} R_\theta$.

TYPICAL AMPLIFIER SIZE

400-800 watts per woofer is the optimal amplifier size. Amplifiers of this size will allow maximum output with minimal risk of speaker damage when properly used. Smaller amplifiers can also be used with excellent results—the full capabilities of the speaker will simply not be used.

POWER-HANDLING TEST

Electro-Voice components and systems are manufactured to exacting standards, ensuring they will hold up, not only through the most rigorous of power tests, but also through continued use in arduous, real-life conditions. Two main test specifications are used: the "AES Recommended Practice for Specification of Loudspeaker Components Used in Professional Audio and Sound Reinforcement" (AES2-1984/ANSI S4.26-1984) and the "EIA Loudspeaker Power Rating Full Range" (ANSI/EIA RS-426-A 1980). Both of these specifications use noise spectrums which mimic typical music and test the thermal and mechanical capabilities of the components. Electro-Voice will support relevant additional standards as and when they become available. Extreme, in-house power tests, which push the performance boundaries of the components, are also performed and passed to ensure years of trouble-free service.

Specifically, the DL15X passes ANSI/EIA RS-426-A 1980 with the following values:

R_{SR} = 6.9 ohms (1.15 x R_E)
P_E(max) = 400 watts
Test voltage = 52.5 volts rms,
105.0 volts peak
(+6 dB)

The DL15X passes AES2-1984/ANSI S4.26-1984 with the following values:
Z_{MIN} = 8.0 ohms at 230 Hz
P_E(max) = 400 watts
Test voltage = 56.6 volts rms,
113.2 volts peak
(+6 dB)
Selected decade = 50-500 Hz

RESPONSE IN STANDARD BAFFLE

AES requires a large, planar baffle for this test, WHICH IS INTENDED TO SHOW SMOOTHNESS AND OFF-AXIS RESPONSE, NOT BASS RESPONSE. This has proven to be inconvenient and prohibitive, due to its size. Here, we have chosen our lab-standard, low-diffraction, 12-cubic-foot test enclosure, which will demonstrate the same characteristics as the AES standard baffle (see Figure 2). A smoothed swept-sine-wave input is used for this measurement to provide a more informative curve to the end user.

TYPICAL ENCLOSURES

The most extended bass, lowest distortion and best control is usually realized in properly designed vented enclosures. In such designs, the vent, or port, actually provides the lowest octave of output. The vent is driven to full acoustic output by a relatively small motion of the speaker cone itself, acting through the air contained within the enclosure. The excursion of the DL15X at these frequencies is much reduced compared to sealed or open-back enclosures, directly reducing harmonic distortion and the possibility of speaker bottoming. See Figure 11 for maximum potential output over the frequency range. Vented-enclosure recommendations follow, some incorporating low-frequency equalization. Thiele-Small parameters are provided so designers can tailor the response to suit their needs.

Normally Tuned Enclosures

See Figures 9A and 9B. The 6-cubic-foot enclosure is tuned to 35 Hz and has an extended response to below 40 Hz. The 4-foot enclosure has a response that "bumps up" from 60 to 110 Hz but has less extended low-bass output.

Also, Pro Sound Facts No. 7, "DL Series Woofers—Plans for Recommended Vented Enclosures and Small- and Large-Signal Performance for These Enclosures," is available from Electro-Voice at no charge. A wide variety of enclosure sizes and degree of low-frequency extension is described in this literature.

Step-Down Operation

The "step-down" mode approximates a B_6 Thiele alignment. Step-down extends system low-frequency response by increasing amplifier power at certain frequencies instead of enclosure size. In step-down, the enclosure is tuned to a lower frequency than normal. This increases system output in the region of the new tuning frequency and reduces output slightly in the region of original tuning. The smoothly falling response which results can be equalized to

4. Teflon® is a registered trademark of DuPont.