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Application

The E-V 30W represents a dramatic new development in the art of bass speaker design. Naturally, it has aroused widespread interest and excitement among audiophiles and music lovers alike. The 30W, with its 30-inch diameter cone, utilizes a 9 lb. 4 oz. ceramic magnet assembly which provides a total gap energy of 28, 100, 000 ergs, producing 13,500 gauss flux density, and 257,000 lines total flux across a gap of greater than usual thickness. This makes possible a deep, 2-1/2 inch, extra heavy gauge, edgewound copper voice coil, having low d.c. resistance. The free space cone resonance of the 30W is 15-25 cps, and its power handling capacity is 50 watts rms continuous sine wave or 100 watts program material. Nominal impedance in the Patrician 700 enclosure is 16 ohms; in most other designs, it is 8 ohms. The speaker is constructed on a rigid, one-piece, die-cast aluminum frame. The quality and rigidity of construction of the unit is attested to by its new weight of 43 lbs. The crossover point may be as high as 300 cps, although the recommended crossover frequency for the 30W is 100 cps.

Why A 30-inch Woofer

The acoustic power output of a smaller woofer is less because of its lower radiation resistance at low frequencies (unless, of course, this smaller woofer is loaded into a large horn). This means simply that even though the smaller cone may move through large excursions, little real acoustic power is produced when loaded in typical enclosures. A typical 12" woofer, for example, has an effective radiating area of only about 80 square inches. Even an excursion of one inch peak-to-peak delivers less than one acoustic

watt at 40 cycles, where, due to reduced ear sensitivity in this range, high acoustic power is necessary to fully recreate the exciting and awe-inspiring qualities of instruments such as the pipe organ and big bass drum. High level low frequency acoustic power is an important ingredient in musical literature and human experience, and no small or inexpensive means exists to produce these effects.

The 30W, with its cone area of more than FIVE HUNDRED SQUARE INCHES, provides the needed tremendous increase in radiation resistance, coupled with a revolutionary new foamed polystyrene cone which maintains true piston action, and permits levels of performance in the extreme bass range never before achieved.

Specifications

Frequency Response:	20-300 cps. (varies with enclosure)
EIA Sensitivity Rating:	51 db
Free-Space Cone Resonance:	15-25 cps.
Recommended Crossover	100 cps.
Power Handling Capacity:	50 watts RMS Continuous sine wave
(in recommended enclosure)	100 watts Program
Critical Damping Factor:	10 or higher
Nominal Impedance:	16 ohms (Patrician 700)
	6-8 ohms (in sealed box or wall mounted)
D.C. Resistance:	3-4 ohms
Voice Coil:	2-1/2" dia. edge-wise wound copper ribbon.
Magnet Weight:	9 lb 4 oz. ceramic
Total Gap Energy:	28, 100, 000 ergs
Flux Density:	13, 500 gauss
Total Flux:	257, 000 lines
Size:	29-3/4" D.x 13-1/2" Deep
Baffle Opening:	28-1/4" dia.
Mounting:	6-3/8" holes equally spaced on 28-15/16" circle
Net Weight:	43 lbs.
Shipping Weight:	48 lbs.

Enclosures

As in the case of any quality bass speaker, performance will depend to a large degree on the particular enclosure utilized. The recommended enclosure for the 30W is the Electro-Voice Patrician 700. This is, in essence, a cavity of 15-1/2 cubic feet enclosing the rear of the woofer, and a straight axis horn of 300 square inches throat area, 10-1/2 inch path length, and 464 square inches mouth area loading the front of the woofer, and leading into the corner of the room for completion of the horn.

The Patrician 700 enclosure has been designed to complement the 30W, and response to 25 cps and below can be achieved with this combination. However, for those applications where it is impossible to employ the Patrician, the following alternative enclosures may be used with good results.

Recommendation No. 1

The best alternative is a Phase Loaded Corner enclosure. (See Figure 1.) If no corner is available, the same enclosure may be used along a wall as shown in Figure 2.

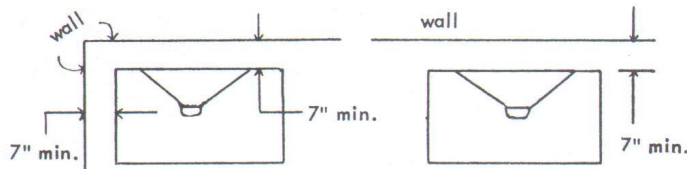
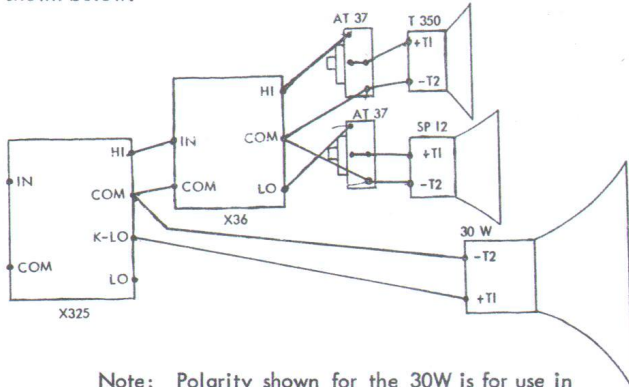


Figure 1

Figure 2

SYSTEM B

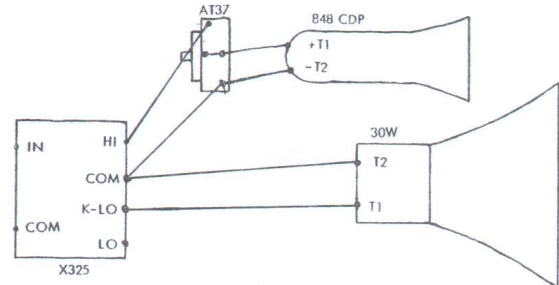
An alternative and very satisfactory system for musical reproduction would be the 30W, the X336 crossover, the SP12 and the T350 as shown below.



Note: Polarity shown for the 30W is for use in simple, closed box as a direct radiator. In the phase-loaded arrangement, polarity of the 30W should be opposite of that shown.

SYSTEM D

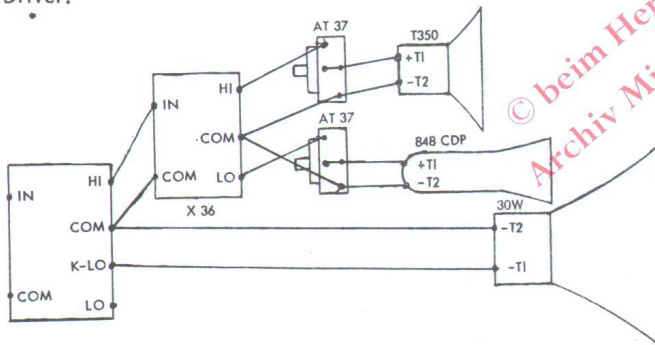
For highest quality public address applications in auditoriums, concert halls, etc., the 30W in suitable enclosure may be used with the X325 crossover and the 848 CDP. In this instance, the RE35 Range Extender may be mounted integrally on the 848 to extend high frequency response beyond audibility and at the same time afford superior dispersion as required in covering large areas.



Note: Polarity shown for the 30W is for use in simple, closed box as a direct radiator. In the phase-loaded arrangement, polarity of the 30W should be opposite of that shown.

SYSTEM C

In utility installations, the 30W may be combined with the X336, the 848 Compound Diffraction Projector and the T350 or T35 VHF Driver.



Note: Polarity shown for the 30W is for use in simple, closed box as a direct radiator. In the phase-loaded arrangement, polarity of the 30W should be opposite of that shown.

Note that in all the above systems, proper phasing of the 30W depends upon the type of enclosure in which it is housed.

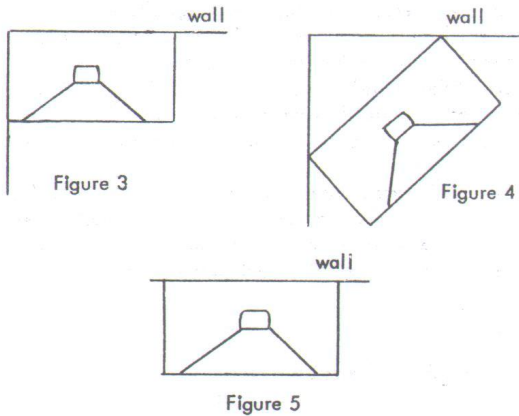
Due to the non-directionality of very low frequencies, the enclosure housing the 30W may be located at some distance from the other speaker system components if need be. This will be a distinct advantage when the 30W is to be used in the home, and may prove to be beneficial in the mounting of public address systems. Where possible, naturally, for convenience in wiring, the bass system will be positioned in the same plane as the other components (along the wall, etc.).

ADDITIONAL ASSISTANCE

It is conceivable that applications in the field may require elaboration on the foregoing suggestions. Electro-Voice is at your service to help in planning particular installations or to aid you with any problems which may arise. Address inquiries to the attention of the Manager, Consumer Products Division, Electro-Voice, Inc., Buchanan, Michigan.

When inquiring about commercial sound installations, please include details and sketches of building design and acoustic conditions, intended uses of the system, number of listeners, etc. for the most complete assistance.

The second best cabinet design is the direct radiator type, which should, if possible, be placed in a corner (Figures 3 and 4), but may be used along the wall, if necessary, as in Figure 5.



In the above enclosures, the absolute minimum volume is 15 cubic feet. System resonance will be approximately 40 cps in a 15 cubic foot Phase Loaded cabinet. Better performance and somewhat lower resonance is possible in a 20 cubic foot cabinet. Cabinet shape may be almost anything desired, but long "chimney" shapes are to be avoided. Material should be 1" plywood. Adequate internal bracing to guard against spurious cabinet resonances is important, and a liberal application of 2 x 4 stock is recommended. The baffle cutout should be 28 inches in diameter.

When the 30W is crossed over above 100 cps, proper internal acoustical treatment of the enclosure becomes important because of the large cavity compared to the wavelength above 100W. All inside surfaces except the panel on which the woofer is mounted should be padded with fibreglass insulation at least three inches thick, quilted as shown in Figure 6. Nailing with washers under the nail heads will provide the quilted configuration, which increases the area of absorptive surface, and makes it irregular, like the wedges in an anechoic chamber.

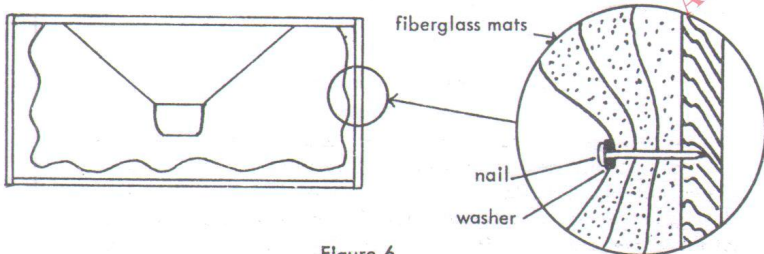


Figure 6

Recommendation No. 3

Excellent results may also be obtained through the mounting of the 30W in the wall between two rooms. The room into which the rear of the woofer faces must be at least 15 cubic feet in volume, and must be protected from weather and extremes in temperature.

Mounting the 30W in the wall will probably necessitate the removal of approximately 30 inches of one stud. Structural rigidity may be maintained through the use of a header and sill above and below the speaker as in Figure 7.

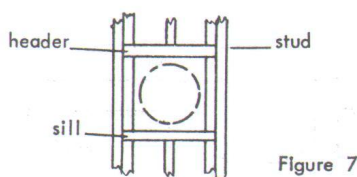


Figure 7

Before proceeding with the mounting of the 30W in this way, however, it is extremely advisable to consult with a competent architect or builder.

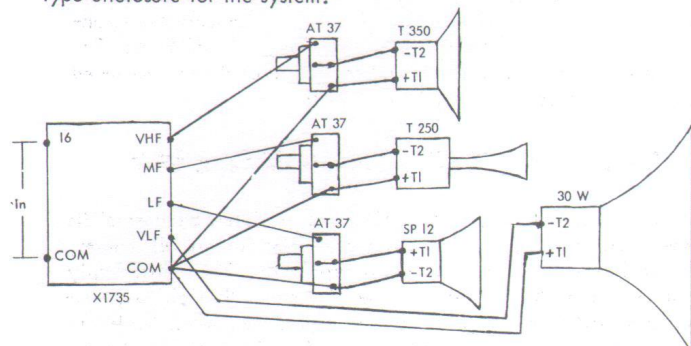
Complementary Components General

The basic requirements for any component or group of components to be used with the 30W to cover the middle and high frequency range are (a) frequency response from 300 cycles or lower up to whatever high frequency limit is desired, with reasonable smoothness and low distortion and (b) fairly high efficiency, such as is found in a 12" direct radiator with high magnet energy and a light moving system. The Electro-Voice SP12 would be an example of such a driver. Full range speakers or woofers with moving systems that are unusually heavy in relation to their radiation resistance, on the other hand, are not suitable because they are too inefficient compared to the 30W, and the use of a level control with the 30W to cut down its sensitivity would impair its transient response. This heavy-moving system type of speaker is generally associated with speaker systems in which an attempt is made to achieve both small size and extended bass response. To obtain this extended bass response with a small enclosure, the moving system must be weighted or made much heavier than usual, regardless of the type of suspension used and no matter how compliant it is made. (The extra work that must be done in vibrating this weight reduces efficiency.) Thus, you can usually assume that if a component is associated with an ultra compact enclosure design, it probably is not suitable for use with the 30W, but if this component has high magnet power for its type (i.e. 3 lbs. of Alnico V and a total gap energy of 11,900,000 ergs, as in the SP12, is high for a 12" speaker) and is associated with enclosures of conventional size (bass reflex, folded horn, etc.) it probably is suitable for use with the 30W. Another criterion would be EIA sensitivity rating, and this should not be appreciably less than 50 db.

So long as the above requirements are met, a wide variety of arrangements may be used to cover the middle and high frequencies in systems using the 30W. A single high quality full-range speaker, such as the SP15, while naturally not comparable to a battery of specialized units such as those used in the Patrician 700, will serve the purpose and may, of course, be expanded later by the addition of very high frequency and treble drivers. If a high quality full-range speaker is already on hand, the 30W may be added to it to extend the bass range and reduce distortion, just a super tweeters have for years been added to full-range speakers to give cleaner, more extended highs. The addition of the 30W "super woofer", with the X325 or other suitable crossover network which keeps low frequencies out of the high channel as well as keeping high frequencies out of the high channel as well as keeping high frequencies out of the woofer, to any existing conventional system, will substantially reduce distortion of the middles and highs as well as extend its bass range.

SYSTEM A

The ideal choice for fine music systems would be the complement of drivers used in the Patrician 700 system. These include the X1735 crossover, the SP12 mid bass, the T250 treble and T350 very high frequency drivers. This combination provides a magnificent four-way system with crossover points at 100, 700 and 3500 cps and response from 20 to 35,000 cps. This complement of components is available with necessary wiring harness and level controls as E-V system Model 103F. These components are also available individually, and many existing high fidelity speaker systems can be expanded to approximate the Patrician 700 through the addition of the 30W and other suitable components, and building a Patrician 700 type enclosure for the system.



Note: Polarity shown is for 30W in Patrician 700 enclosure. In other designs, the opposite polarity might be required.



better is the proper connection. If there seems to be no difference when the change is made, then either connection is proper. This test is recommended because variations in speaker spacing and room acoustics may cause cancellation, rather than reinforcement, near the crossover frequency.

CUSTOMER SERVICE

The 30W is packed to provide protection well in excess of shipping requirements of the Interstate Commerce Commission. If shipping damage does occur, contact the carrier or the dealer from whom the unit was purchased and request inspection and instructions.

WARRANTY (Limited)

Electro-Voice high fidelity speakers, speaker systems, and accessories are guaranteed for five years from date of original purchase against malfunction due to defects in workmanship and materials. If such malfunction occurs, unit will be repaired or replaced (at our option) without charge for materials or labor if delivered prepaid to the proper Electro-Voice service facility. Unit will be returned prepaid. Warranty does not cover finish or appearance items or malfunction due to abuse or operation at other than specified conditions. Repair by other than Electro-Voice or its authorized service agencies will void this guarantee.

For correct shipping address, instructions on return of Electro-Voice products for repair, and locations of authorized service agencies, please write: Service Department, Electro-Voice, Inc., 600 Cecil Street, Buchanan, Michigan 49107 (Phone 616/695-6831).

Electro-Voice also maintains complete facilities for non-warranty service of E-V products.

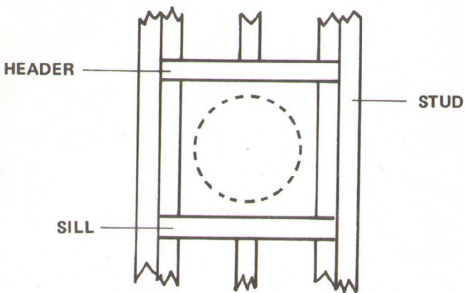


FIGURE 4 - Wall Mounting

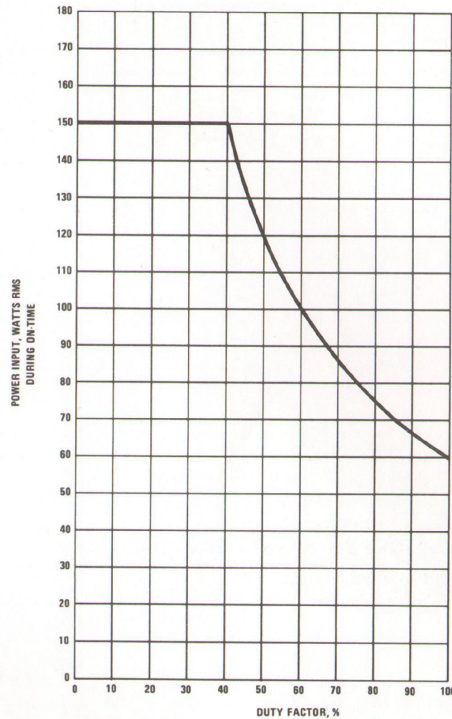


FIGURE 5 - Power Input vs Duty Factor



DESCRIPTION

The Electro-Voice Model 30W woofer represents a dramatic development in the art of bass speaker design. Previously unattainable low-frequency performance results from the combination of a massive magnet structure, heavy duty, edgewise wound copper voice coil, and a rigid, polystyrene foam cone. A one-piece, diecast aluminum frame assures permanent component alignment while minimizing unit weight. As a result, the nine pound four ounce ceramic magnet in a twenty-three pound magnetic circuit accounts for over two-thirds of the total unit weight.

Reduced ear sensitivity in the low-frequency range requires high acoustic power to fully recreate the exciting and awe-inspiring qualities of instruments such as the pipe organ and bass drum. Because radiation resistance of a speaker at low frequencies is proportional to the cone radiating area, acoustic power output of a smaller woofer is far less for a given excursion. Even an excursion of one inch peak-to-peak with a typical twelve inch woofer delivers less than one acoustic watt at 40 Hz. The 30W, with a cone area of more than 500 square inches, provides the needed tremendous increase in radiation resistance and permits levels of performance in the extreme bass range never before achieved. Even at full power input, cone motion is within the linear range.

SPECIFICATIONS

- Resonance: 15 Hz ±3 Hz
- Impedance, Nominal: 8 ohms
- Minimum: 5 ohms
- D C Resistance: 4 ohms

Power Handling Capacity,

- RMS: 60 watts
- Pulsed: 150 watts
- (See Figure 6) 10%

Conversion Efficiency:

10%

EIA Sensitivity Rating:

54 dB

Recommended Crossover:

100 Hz

Voice Coil Diameter:

2½ inches

Magnet:

9 lb., 4 oz., ceramic

Dimensions:

29¾" dia., 13-13/32" depth behind wall

Net Weight:

34 pounds

Baffle Opening:

28¾ inches

Mounting:

6-3/8" holes equally spaced on 28-7/8" circle

ENCLOSURE DESIGN

As is the case with virtually any speaker, the enclosure determines the actual performance of the 30W. There are a number of enclosure approaches suitable for the 30W, each with certain special advantages, depending upon the intended use of the speaker.

All recommended enclosures are sealed (acoustic suspension) types. Ported enclosures (bass reflex) are neither necessary nor desirable for the 30W. Many factors can be varied to establish desired performance:

1. Enclosure volume
2. Damping material
3. System environment
4. Mass loading

ENCLOSURE VOLUME—Figure 1 shows the variation of

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speaker resonance as the enclosure volume changes. Because it is the response curve which is of interest, rather than simply speaker resonance, Figure 2 shows representative response curves under anechoic or free-field conditions. Enclosure volumes of 22, 50 and 300 cubic feet yield speaker resonances of 40, 30 and 20 Hz., respectively.

As the enclosure gets smaller and the speaker resonance goes up, the speaker tends to become underdamped, yielding a rise in the response curve at resonance. An "optimum" response curve should be approximately 3 dB down at resonance. The change in damping is a very broad effect, with curves C and E representing an enclosure volume ratio of 13 to 1. By combining this effect with other variables which are controllable, the response of the completed system can closely match requirements.

ACOUSTIC DAMPING MATERIAL—An underdamped speaker can be compensated for through the use of acoustic resistance added inside the enclosure. Fiberglass builder's insulation, available in batts and rolls for use between joists and studs, is an inexpensive and effective damping material. Any paper or foil backing should be removed before inserting the fiberglass in the enclosure. Filling the enclosure until the fiberglass is slightly compressed will reduce the resonant frequency up to 10%, as well as slightly increasing the damping.

SYSTEM ENVIRONMENT—The space in which the speaker is used can affect its performance as much as any other factor involved. If the speaker is placed in an extremely large area, away from reflecting surfaces, its output will tend to be the same as anechoic or free-field conditions. If a speaker is placed against a solid wall, the junction of two walls, or in a corner formed by three walls, ($\frac{1}{2}$ space, $\frac{1}{4}$ space, and $\frac{1}{8}$ -space conditions) the low frequency energy is contained in a smaller angle of radiation, and the bass response will tend to rise. In an extremely large space approximating free-field, a response curve which is somewhat underdamped may provide the most satisfying performance. On the other hand, close reflecting surfaces will tend to boost low-frequency response, making an overdamped (rolled off) free-field curve more desirable. This can be achieved through the use of a larger enclosure and/or fiberglass damping.

MASS LOADING—When enclosure volume is severely limited, mass loading can be used to reduce the resonant frequency at a slight sacrifice of efficiency. This principle is employed in the Patrician 800 system, yielding a modest size enclosure with the 30W for home use. The simplest method of mass loading involves increasing the air load on the front of the speaker by facing the speaker toward a rigid surface, such as a wall (Figure 3).

As the speaker is brought closer to the wall, the effective

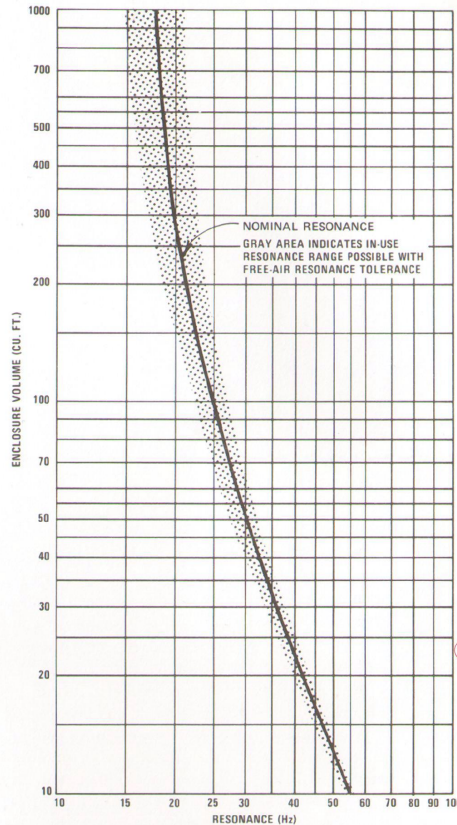


FIGURE 1 — Enclosure Volume vs Resonance

mass of air in front of the speaker increases, lowering the resonant frequency. Resonance can be lowered by as much as 25% with this technique. However, if cabinet space for a large enclosure is available, the conventional approach is preferable to mass loading.

ENCLOSURE CONSTRUCTION

Because any cabinet wall vibration is out of phase with the woofer cone, panel vibrations will cancel a portion of the woofer output. A concrete block enclosure is ideal, but far from practical! One-inch plywood walls, liberally braced with 2x4 sections, is a good compromise method of reducing panel vibration when manageable weight, cost, and ease of construction. Spacing of the 2x4 bracing on any panel should not exceed 24-inches in one direction.

Sixteen-inch spacing provides a more rigid panel and is more convenient to lay out, because most tape measures have sixteen-inch centers indicated for all stud spacing. All joints should be secured with a good grade of wood glue and coated nails, except for removable access panels. These should be secured with No. 8 x 2" woodscrews. Removable panels may be sealed with a closed-cell foam tape such as that used for weather-stripping, or with non-drying caulking compound.

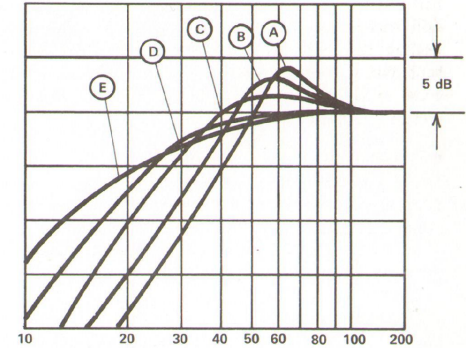
Unlike most enclosures, there is no need to line the interior walls of the cabinet with fiberglass. The purpose of such a lining is to absorb standing waves inside the cabinet. However, the low frequencies of standing waves in 30W cabinets are not affected by a fiberglass lining on the cabinet walls. Adding fiberglass to the enclosure, as mentioned earlier, alters the response curve by lowering the system Q and also reduces the amplitude of standing waves inside the enclosure.

Mounting the 30W in a wall will probably necessitate the removal of more than 30 inches of one stud. Structural rigidity may be maintained through the use of a header and sill above and below the speaker as shown in Figure 4. For convenience, the 30W may be secured to a one-inch plywood mounting baffle which is then screwed to the wall studs and framing. Before proceeding with the mounting of the 30W in this way, however, it is extremely advisable to consult with a competent architect or builder.

CONNECTIONS

If the 30W is mounted in close proximity to the crossover and other components, No. 18 wire (such as ordinary lamp cord) is satisfactory. If the 30W is mounted some distance from the other components, No. 16 or larger wire should be used to keep the resistance losses as low as possible.

Both Model X1835 crossover (as used in the E-V Patrician 800) and Model X1020 crossover are designed specifically



Curve	Volume (cu. ft.)	Resonance	Anechoic Response at Resonance	Damping
A	8.5	60 Hz	+4 dB	Under —
B	12.5	50 Hz	+2 dB	Under —
C	22	40 Hz	0 dB	Under —
D	50	30 Hz	-2.5 dB	"Optimum"
E	300	20 Hz	-6 dB	Over —

FIGURE 2 — Response Curves

for use with the 30W woofer. Model X1835 should be used with the Patrician components, the X1020 crossover allows the 30W to be added to an existing full-range system. The proper crossover frequency is 100 Hz.

In order to assure maximum bass response, a simple phase-reversing test should be made during installation. While playing a source with substantial sound below 100 Hz, such as an organ record, reverse the connections at the woofer. The connections with which bass response sounds

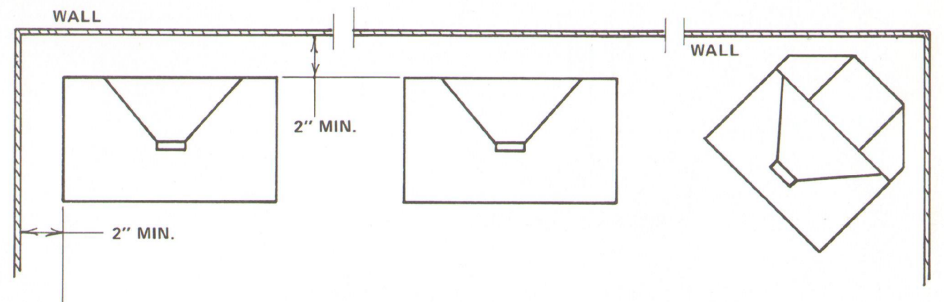


FIGURE 3 — Phase Loaded Enclosures