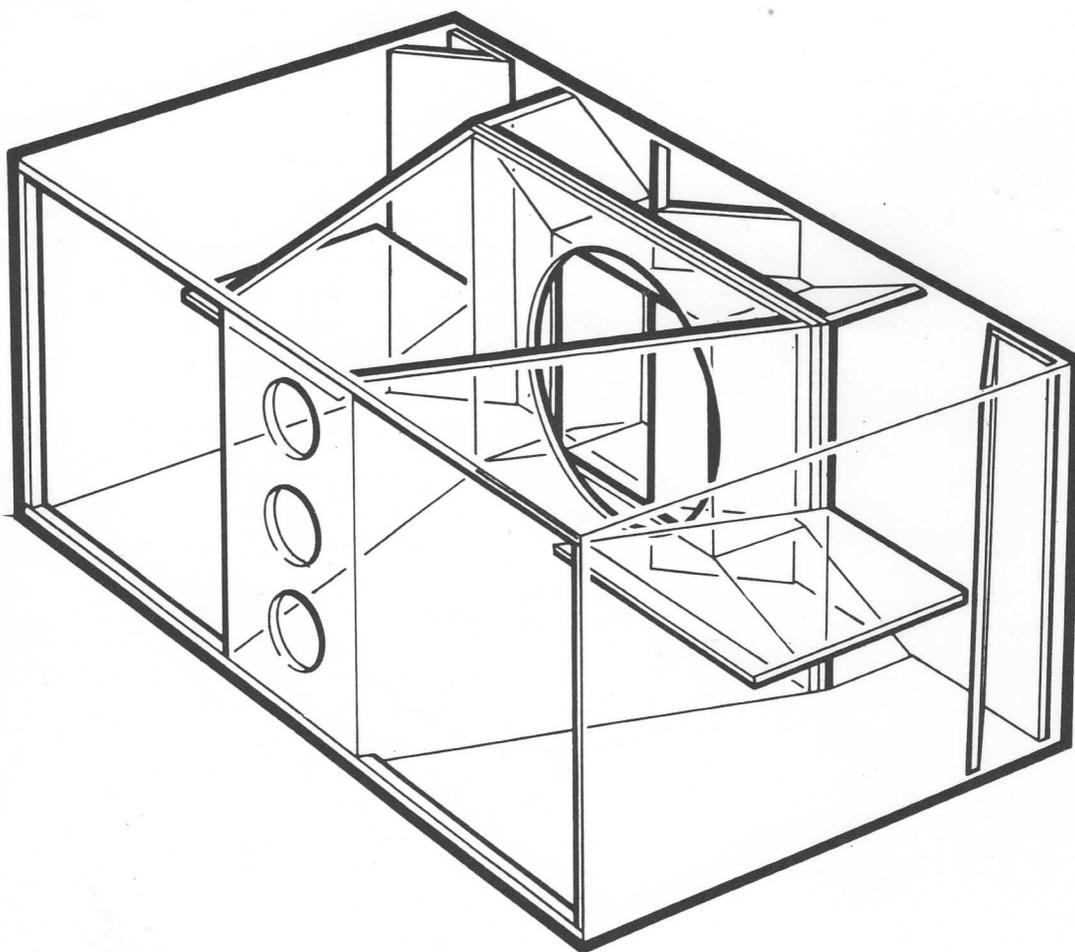


EMINENCE



**HIGH POWER LOUDSPEAKER
ENCLOSURE DESIGN AND
CONSTRUCTION**

HIGH POWER LOUDSPEAKER ENCLOSURE DESIGN AND CONSTRUCTION

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The purpose of this handbook is to enable the amateur constructor and enthusiast, in addition to professional parties, to build loudspeaker enclosures. The designs are applicable for all types of high power sound reinforcement and musical instrument amplification systems. The information given will enable sound systems from fifty to several thousand watts to be correctly made and installed.

The handbook contains a comprehensive technical section covering much of the theory of selecting and matching loudspeaker components, electrical connections, crossover design and use, with details of materials and methods of construction. The theory and science of the most popular types of design is discussed with useful formulae.

Although there are many esoteric approaches to the design of enclosures for sound reinforcement systems, the underlying concepts are the same, and the technical sections will enable the more advanced persons to elaborate on the designs provided. The terminology within these sections has been kept to a minimum for ease of use. References to other works and sources are included, however, to enable students and engineers to obtain further research material.

The book contains thirty designs shown in easy to follow constructional drawings, complete with technical specification data and recommended loudspeaker components.

Disclaimer

Whilst every precaution has been taken in the preparation and writing of this publication, the authors assume no responsibility for any errors or omissions, nor is any liability assumed for damages resulting from the use of the information contained herein, neither is any patent liability assumed with respect to the use of the information contained herein.

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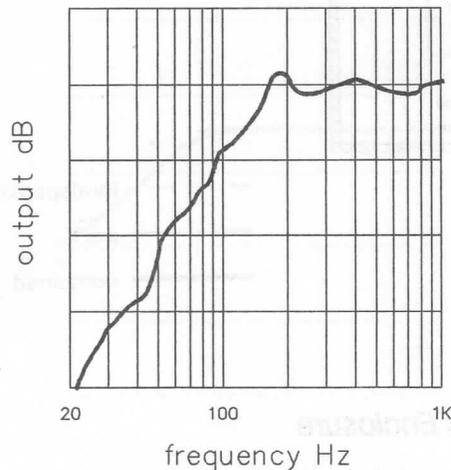
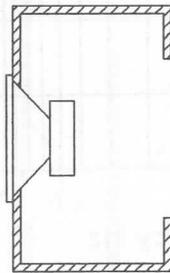
1.1 - review of enclosure types

1.1.1 Loudspeaker Enclosures

The basic need for a loudspeaker enclosure is the necessity to prevent the acoustic out-of-phase radiation from the open rear of the diaphragm detracting from the in-phase output from the diaphragm front. The enclosure must be either sealed, or incorporate some method of phase changing, ie. a tuned port or labyrinth. The enclosure also provides damping at low frequency resonance in the form of acoustic resistance. This means that the loudspeaker enclosure has to be designed to suit the type of unit used, with regard to its moving mass, compliance and free air resonance.

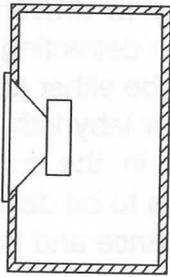
The tuned port enclosures are commonly of the bass reflex type, or quarter wave length ducts.

The technical aspects of sound systems has evolved over the last ten years with respect to sound coverage and dispersion, thereby redefining the methods of utilising enclosures. However the final performance of the loudspeaker is still very much a matter of individual preference, esoteric demands sometimes being irrespective of cost and complexity. The designs and guidelines contained within this handbook offer basic, good, modern engineering practices only.

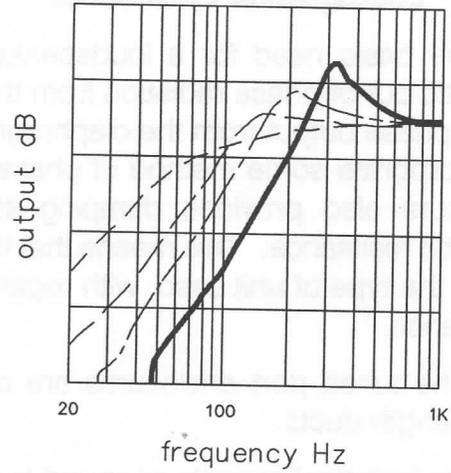


Open Back and Di-pole

Low frequency performance is poor, the design is largely dependent on the surface area of the baffle to reduce out-of-phase radiation. Single frequency cancellation is smoothed by placing the loudspeaker in a non-symmetrical baffle position. Effective output down to 90 Hz, suitable for lead guitar combos.

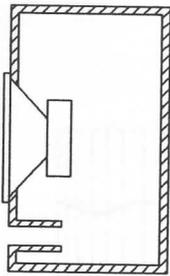


- - - - - Q = 0.5
- — — — Q = 1.0
- · - · - Q = 1.5
- Q = 2.5

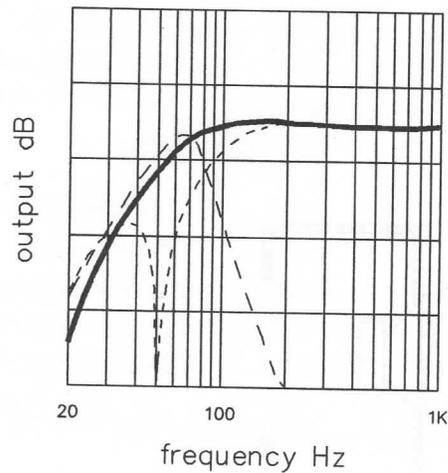


Totally Sealed Enclosure

Low frequency performance is good but is dependent on the physical size of the enclosure and the final value of Q. Ideal for equalised bass and also mid-range uses.



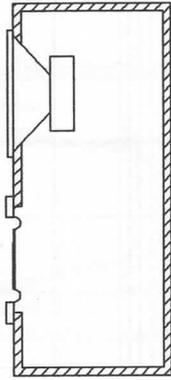
- - - - - loudspeaker
- — — — port
- combined



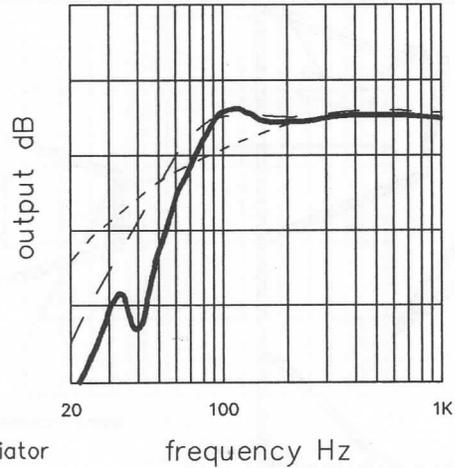
Bass Reflex Enclosure

Very good low frequency performance, but designs are dependent on the particular loudspeakers' parameters and enclosure tuning alignments. These have been mathematically perfected by Thiele and Small and are often quoted on manufacturers' specifications. Currently the most popular type of enclosure.

1.1 - review of enclosure types

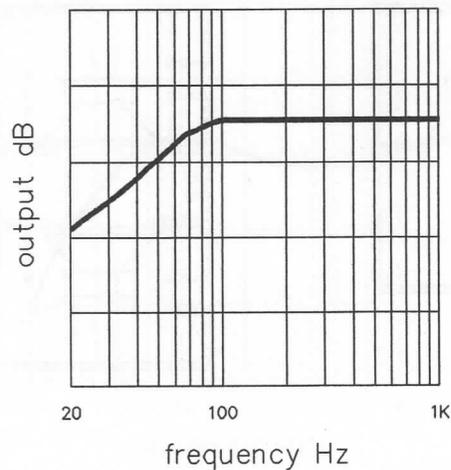
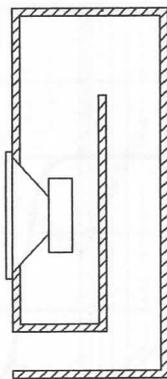


--- closed
— reflex
— passive radiator



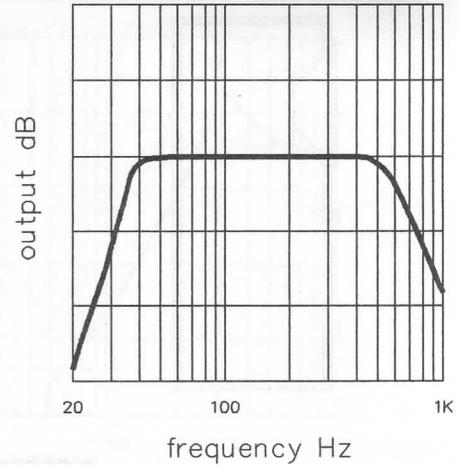
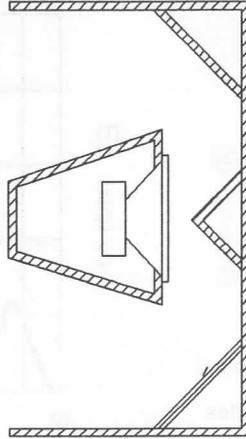
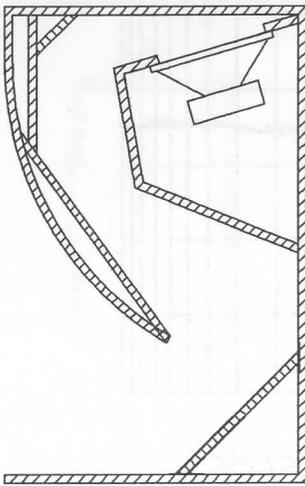
Passive Radiators

The passive radiator is an alternative to the open port in a bass reflex enclosure. They provide the same low frequency extension but without the problems of noises and coloration, and work well with small sized enclosures. However the transient response is poorer than the conventional vented reflex system, particularly at high power levels, thereby restricting their use to Hi-Fi products.



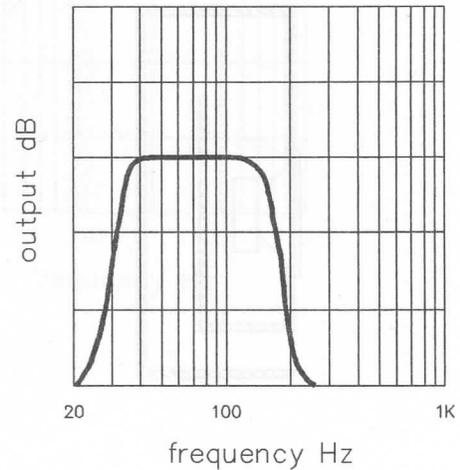
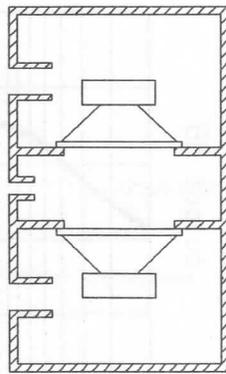
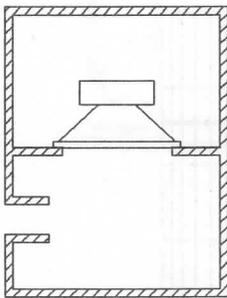
Direct Radiating plus Front Horn Loading

This design provides an improvement of mid-range projection and efficiency by front horn loading the diaphragm. The horn extension produces a change in the directivity and dispersion characteristics of the loudspeaker which is optimised as a 3dB gain in efficiency for frequency above 160 Hz.



Large Folded Horns

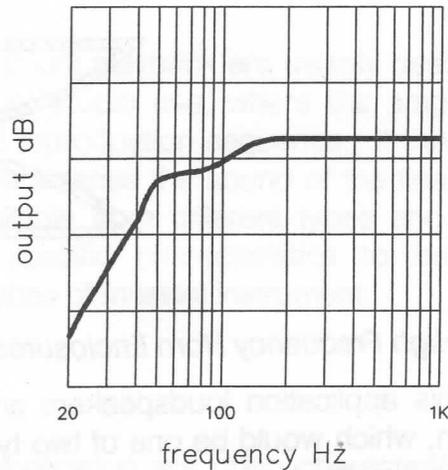
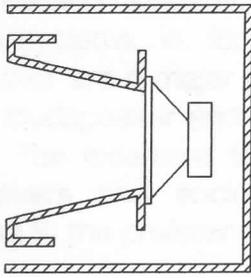
There are many possible methods for designing horn enclosures embracing hybrid conceptions and acoustic filters to achieve specified band widths, frequency response and efficiency. Enclosures are normally large and of complex construction, but if designed and manufactured correctly they can provide the optimum in tight, punchy, high output bass up to 500 Hz.



Frequency Band Pass

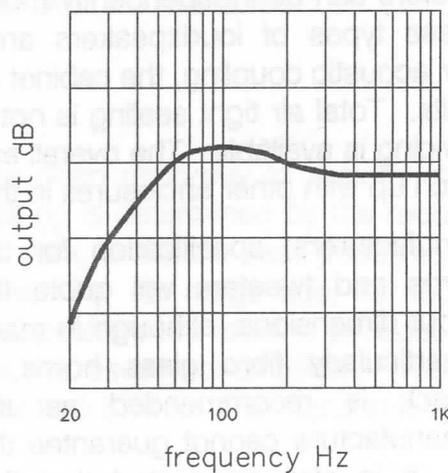
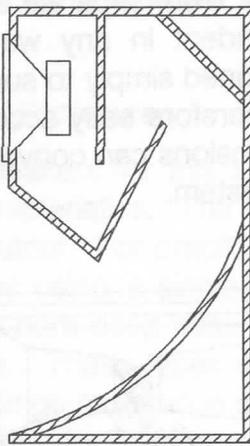
This is a relatively new type of design that has recently become popular for sub-bass applications up to 150 Hz. The driver output is isolated and the vented output has a narrow band pass characteristic normally restricted to three octaves. The design will usually surpass a similar bass reflex enclosure in terms of efficiency.

1.1 - review of enclosure types



Labyrinth or Transmission Line

A 90 degree shift is provided by a quarter wavelength, open ended, rear loading conduit effective at the driver resonant frequency. The design characterised by relatively loud, deep bass with excellent damping. As the cross section needs to be equal to the diaphragm, surface area enclosures are relatively large. This restricts its use commercially to Hi-Fi products with a maximum loudspeaker size of 10".



Direct Radiating plus Rear Horn Loading

In this type of design the loudspeaker is housed in a small chamber with the diaphragm front direct radiating. The small chamber is the throat of a large folded horn that takes up almost the whole enclosure, thereby radiating low frequencies from both sides of the diaphragm in phase. Below 150 Hz, the horn is the dominating factor in the low frequency output, thereby making the enclosure bass orientated. A high output loudspeaker can provide good efficiency with high SPL, therefore making the design eminently applicable for all bass applications.