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Bass Reflex Box Calculator (max. flat amplitude) with the possibility to customize V_b



In the early seventies, A.N.Thiele and Richard H. Small devised a set of formulas to predict how a driver would perform in any given box. Thiele



was the senior engineer of design and development for the Australian Broadcasting Commission and was responsible at the time for the Federal Engineering Laboratory, as well as for analyzing the design of equipment and systems for sound and vision broadcasting. Small was, at the time, a Commonwealth Post-graduate Research Student in the School of Electrical Engineering at the University of Sydney.

Thiele and Small devoted considerable effort to show how the following parameters define the relationship between a speaker and a particular enclosure. However, they can be invaluable in making choices because they tell you far more about the transducer's real performance.

Efficiency Bandwidth Product (**EBP**) is a number which shows the trade-off between efficiency and bandwidth of a driver. It is useful in determining if a driver is suited for a sealed or vented box and is also used to determine suitability for horn loading.

1. Enter the Thiele-Small parameters and calculate the Flat Response (Step 1)
2. V_b , F_b , F_3 , L_p , P_{min} and EBP are calculated and the Frequency Response is plotted
3. EBP - The efficiency bandwidth product, a rough indicator measure is calculated.

A common rule of thumb indicates that for **EBP > 100**, a driver is perhaps best used in a reflex enclosure, while **EBP < 50** indicates a closed enclosure. For **50 < EBP < 100**, either enclosure may be used effectively.

4. Now you can repeat these calculations with a new volume [V_b] for the housing (Step2)
5. Both frequency curves (Flat and Custom) are displayed for comparison

- EBP < 50 - use only for a sealed box
- EBP 50 - 100 - can be used in either
- EBP > 100 - vented box only
- EBP > 130 - can be used for horn loudspeakers

Calculate V_b , f_3 , f_b , L_p and P_{min}

- | | |
|--|---|
| • V_{as} - Volume of air equal to the speaker's spring characteristics | • V_b - The airspace volume of the box. The volume of the driver and any building material needs to be added to this value. |
| • Q_{ts} - Total Q of driver | • F_3 - lower -3db frequency |
| • Q_{es} - Electrical Q factor | • F_b = Box frequency |
| • F_s - Free air resonance of speaker | • L_p - Port length |
| • S_d - Effective piston area | |

- X_{\max} - Driver excursion

- P_{\min} - minimal Port diameter
- **EBP** = Efficiency Bandwidth Product

As a general rule, the vent area should be chosen as large as possible to minimize noise caused by turbulent air flow.

If the area is too large, however, the vent will extend too far into the enclosure and might have its unflanged end too close to the back wall. Ideally, the vent should extend to about one-half the depth of the box.

In the event that it is too long to fit in the enclosure, an elbow shaped vent can be used. Round PVC tubing makes a good vent material. To increase the vent area, two or more equal length vent tubes can be used.

In this case, the length is calculated as if the tubes are a single tube having a cross-sectional area equal to the total area of all the tubes. There is only one Helmholtz frequency when multiple vents are used.

Thiele-Small Parameters :

V_{as} [liters] : 30

Q_{ts} : 0.39

Q_{es} : 0.43

F_s [Hz] : 32

S_d [cm²] : 98

X_{\max} [mm] : 9

EBP : 74.4

Flat Calculation :

V_b [liters] : 26.83

F_3 [Hz] : 33.24

F_b [Hz] : 33.13

L_p [cm] : 12.91

P_{\min} [cm] : 5.41

Q : 5.9

Custom Calculation :

* New V_b [liters] : 5.5

F_3 [Hz] : 61.49

F_b [Hz] : 53.69

L_p [cm] : 26.81

P_{\min} [cm] : 6.9

Q : 1.2

Vent parameters

of Ports : 1

Port diameter [cm] : 4.5 = 15.9 cm²

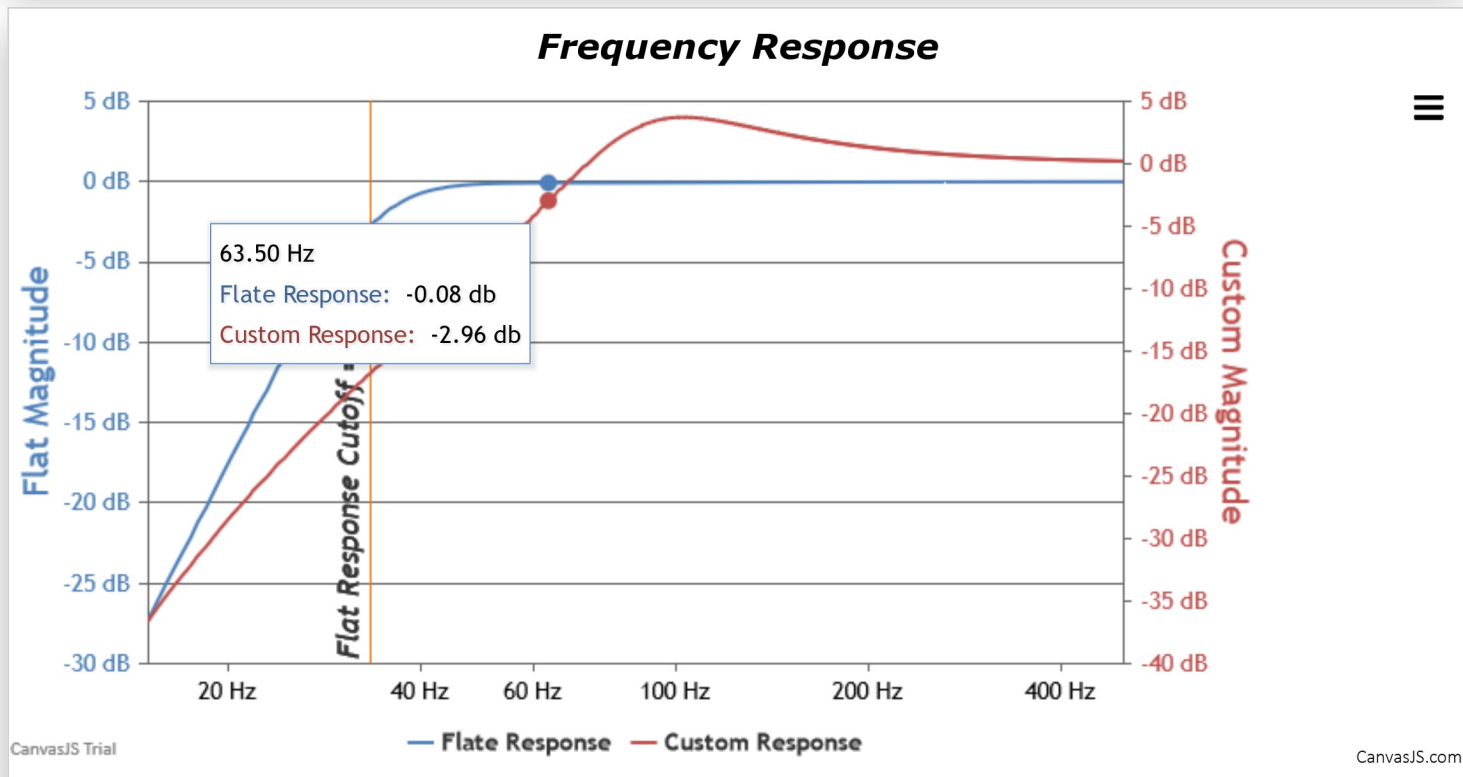


Step 1:

Calculate Flat Response

Step 2:

Recalculate with new Vb



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