8.1 Broadband Absorption

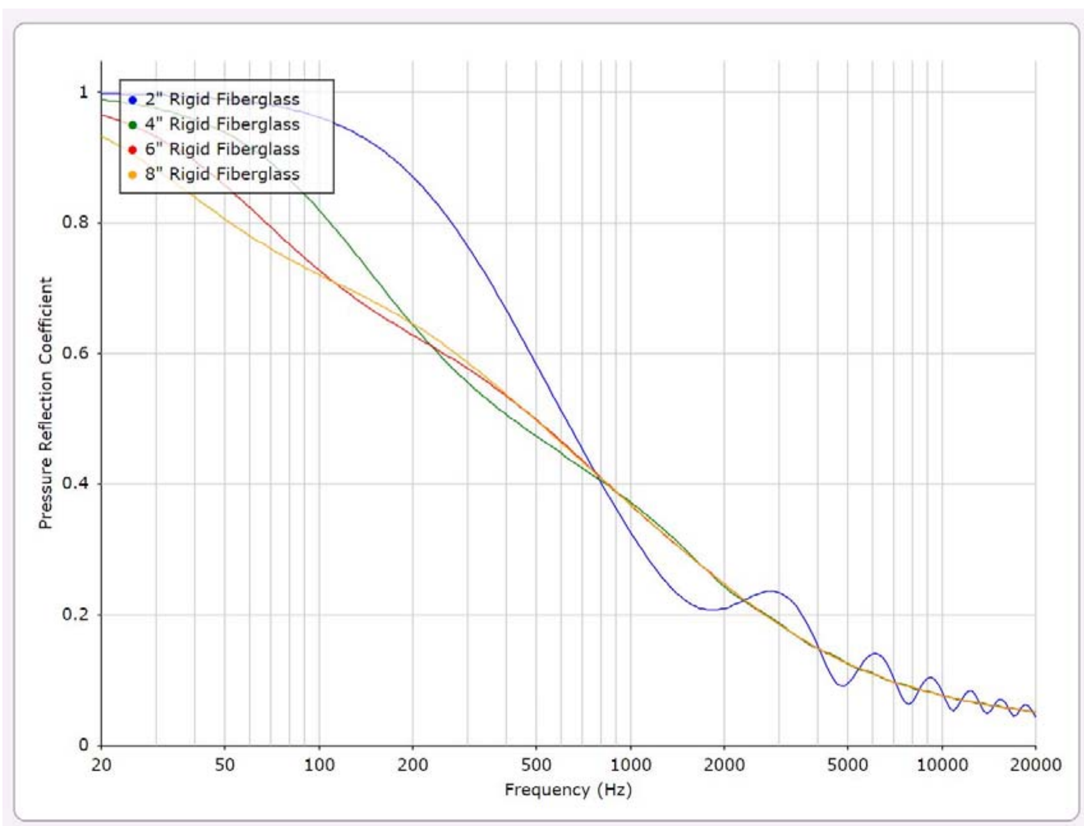
Before you begin making broadband acoustic treatment, a few things need to be addressed.

1. Sound pressure and sound velocity.
2. How do we transfer as much energy as possible into the porous absorption (fiber)?
3. How does impedance affect the transfer?
4. Concerning broadband porous absorption efficiency, what is the lowest effective frequency obtainable?

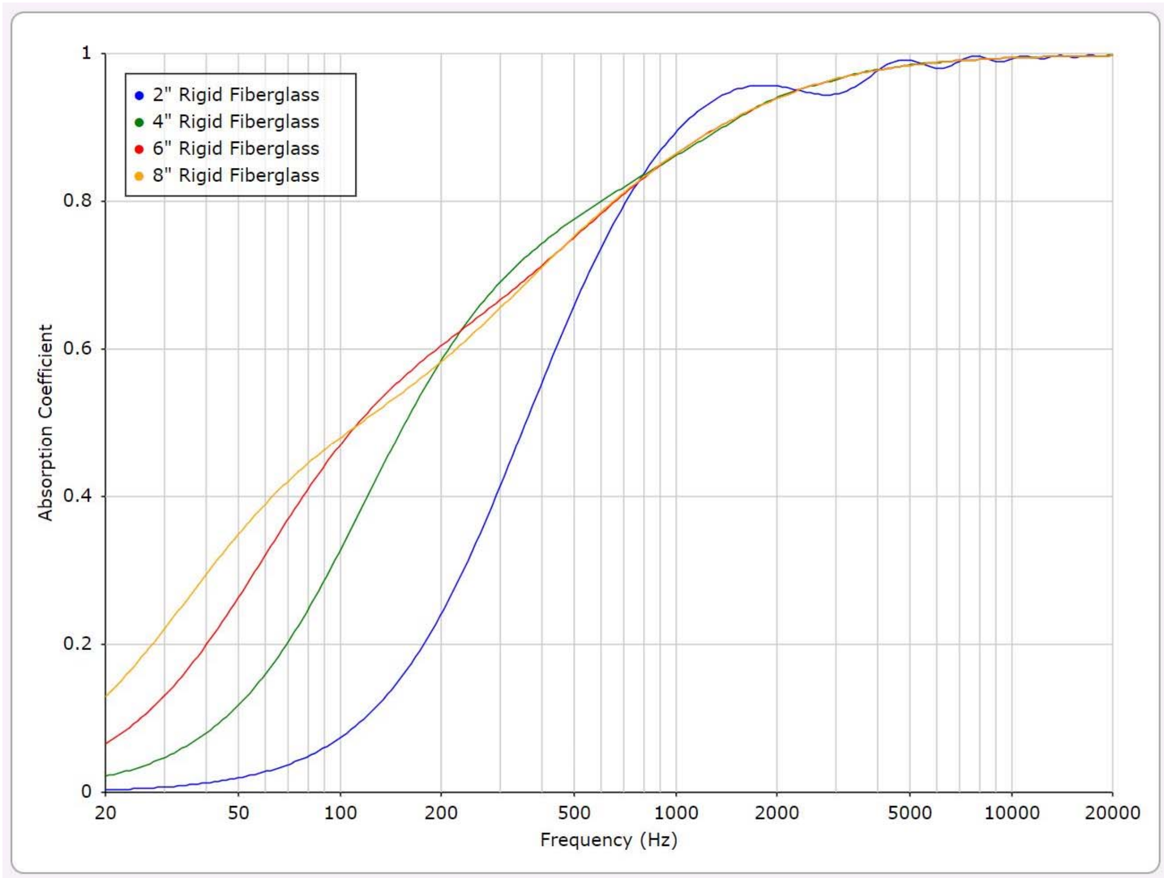
Example: Electronic circuits - If you want the most efficient energy transfer, impedances must be matched. Take an old RCA ribbon mic with a 50-ohm output impedance. The flattest frequency response results when the microphone is matched to a 50-ohm input transformant of a mic pre. The same goes for a piezoelectric contact pickup – matched to a very high impedance preamp >10 Meg Ohms.

To be efficiently absorbed or controlled, sound vibrations in the air need to be met with the same considerations.

The following charts show the modeling of several different types of absorption. Rigid Fiberglass, Lightweight Fiberglass, and composite absorbers.

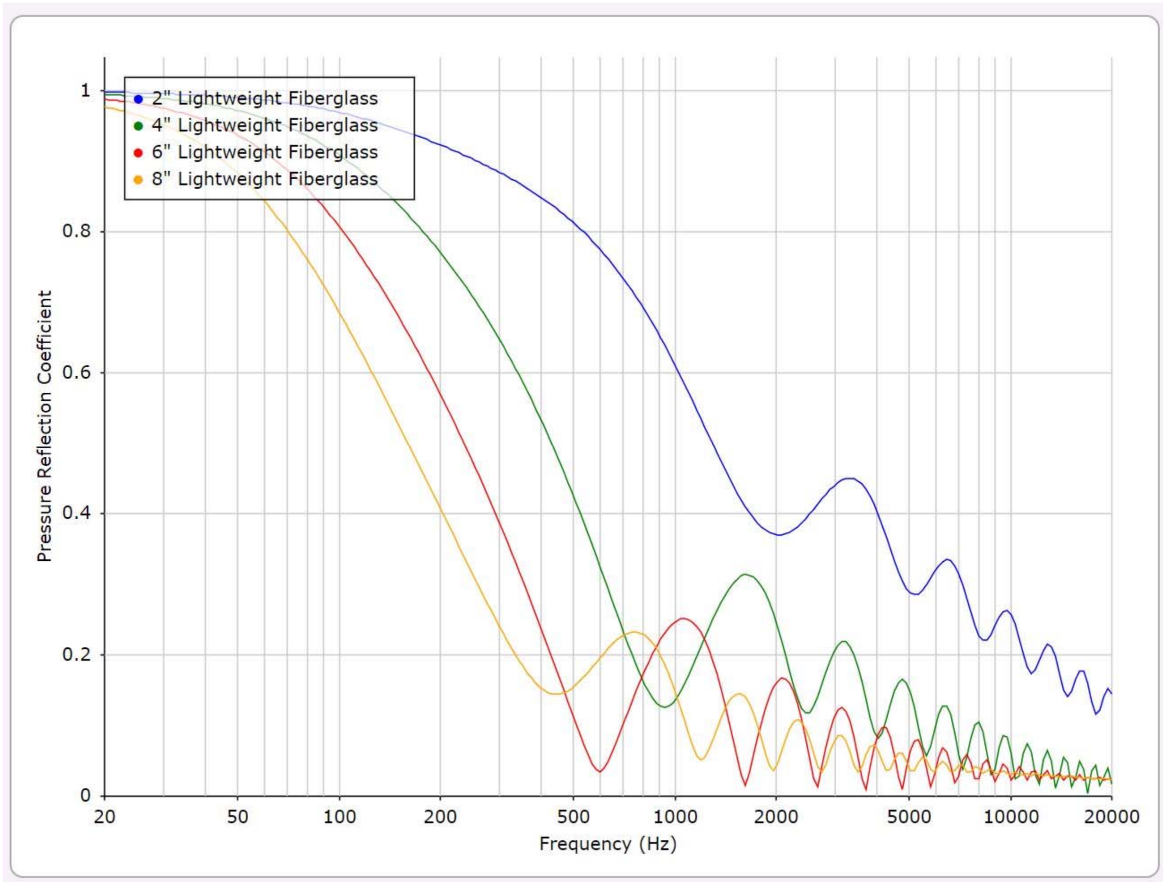


As shown above, the reflection coefficient of high-density glass/rock wool is rather high in the low-frequency region. i.e.; Owens Corning 703

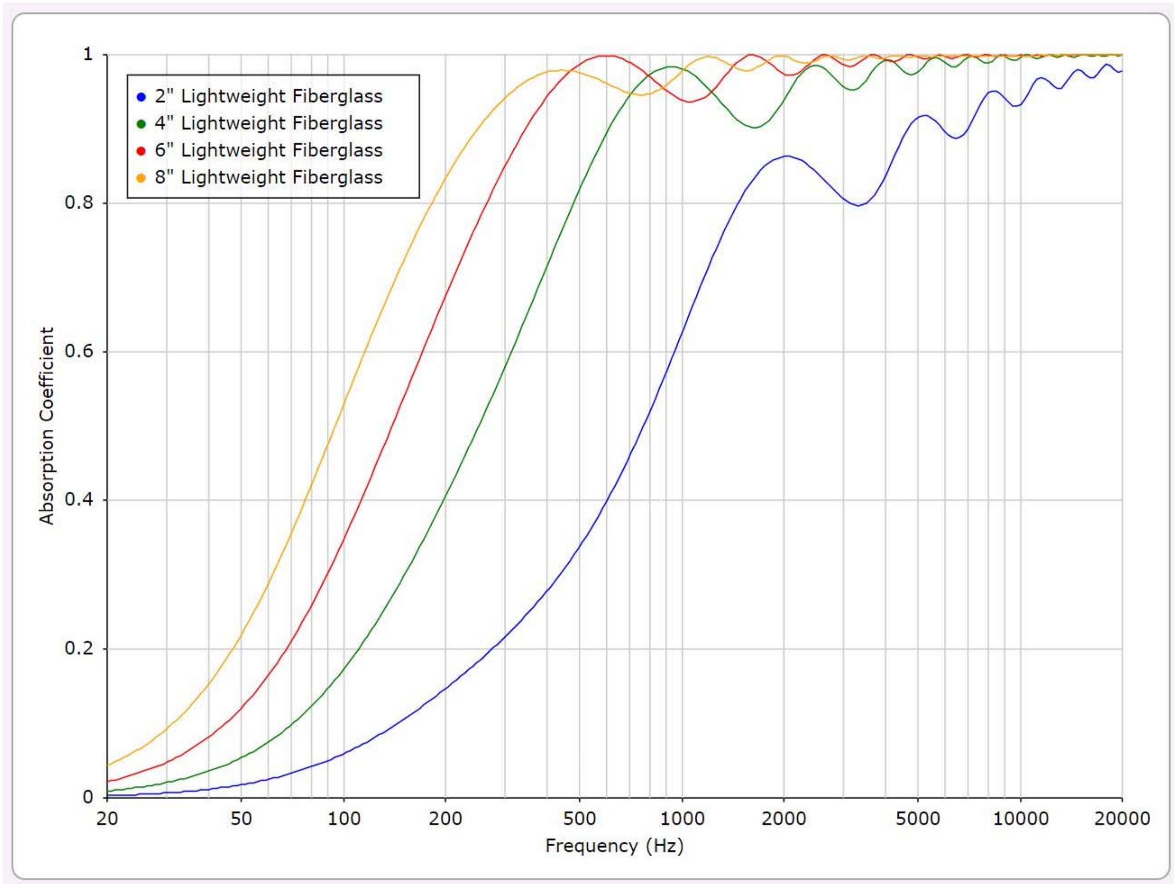


The absorption coefficient of the high-density fiber is poor in the low-frequency region. For conservative reasons, I never look below 0.7 and it is my recommended cut-off point.

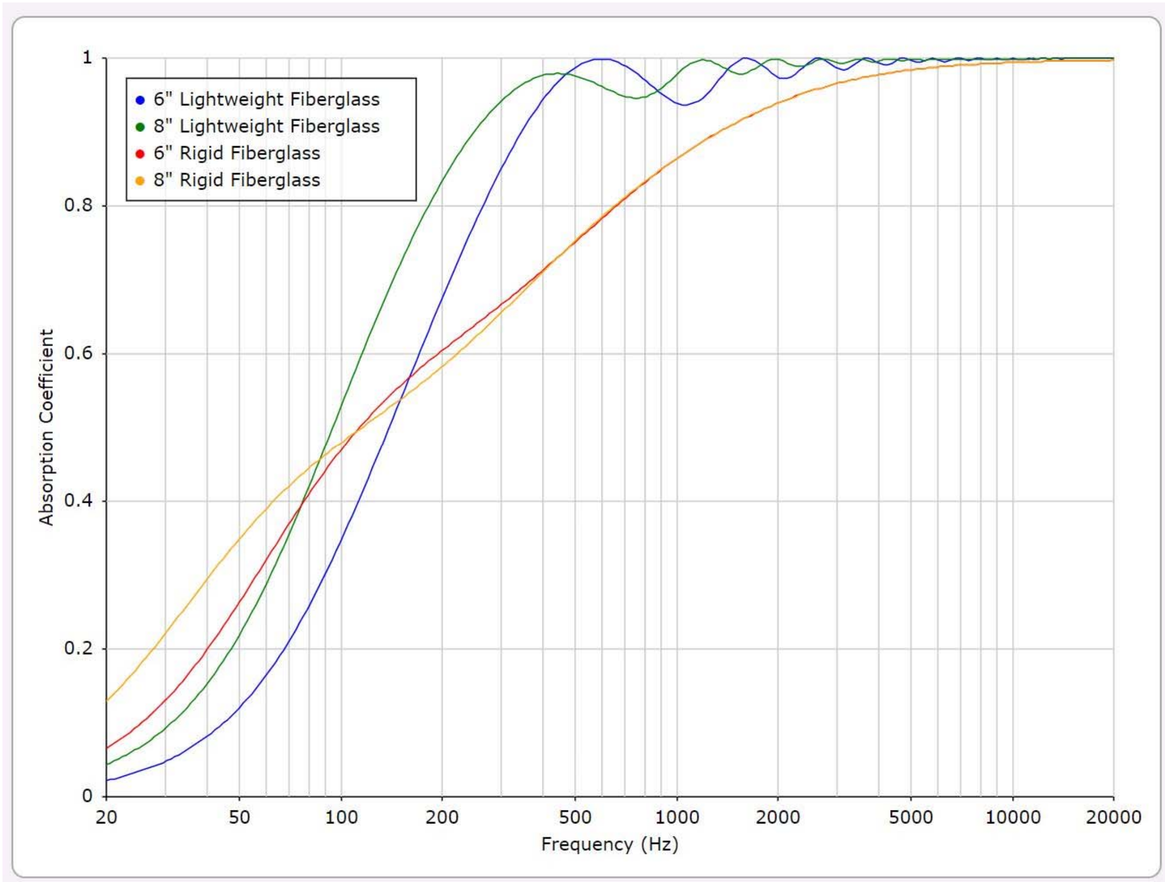
As thickness increases, low-frequency absorption does not. 4” of rigid fiberglass outperforms all others tested. Better than 2”, of course. But also better than either 6” or 8” rigid (703).



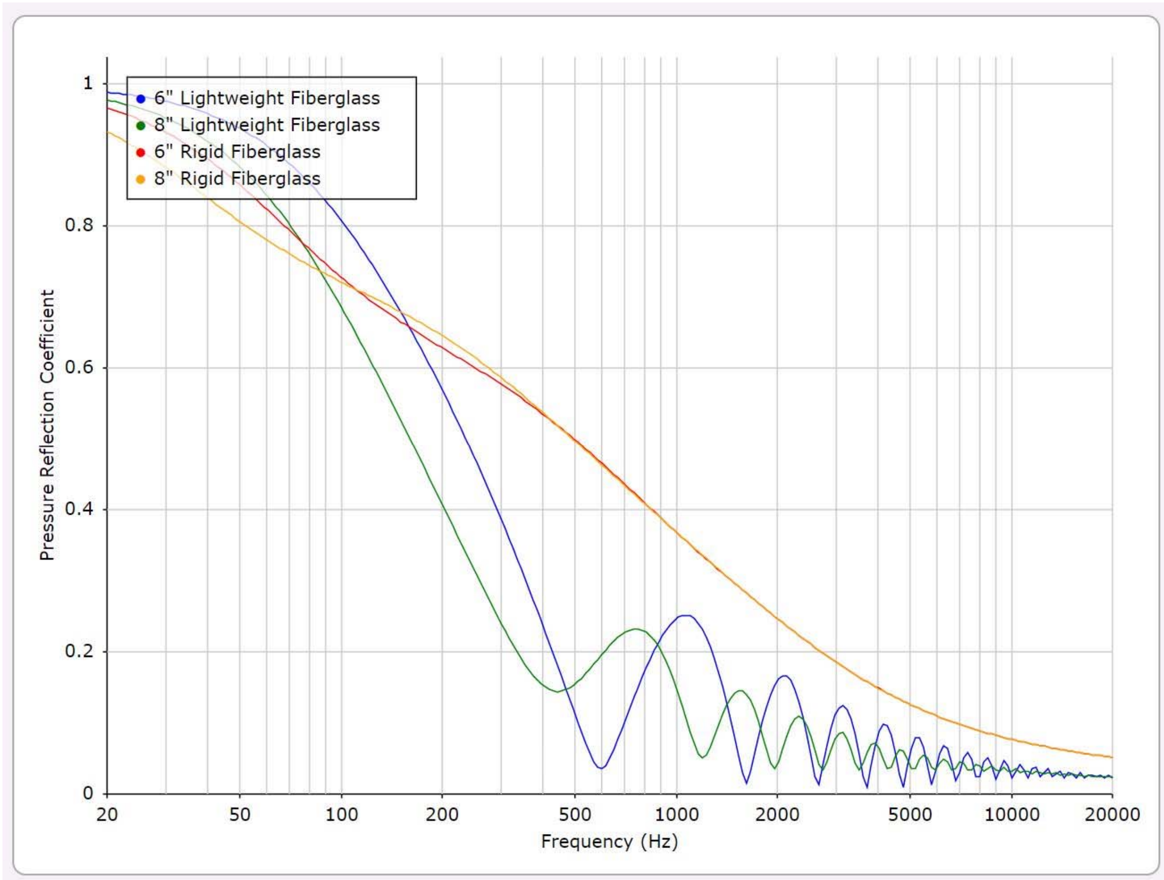
The reflection coefficient for lightweight fiber is shown above. Notice that reflections in the low-frequency region decrease as the thickness increases.



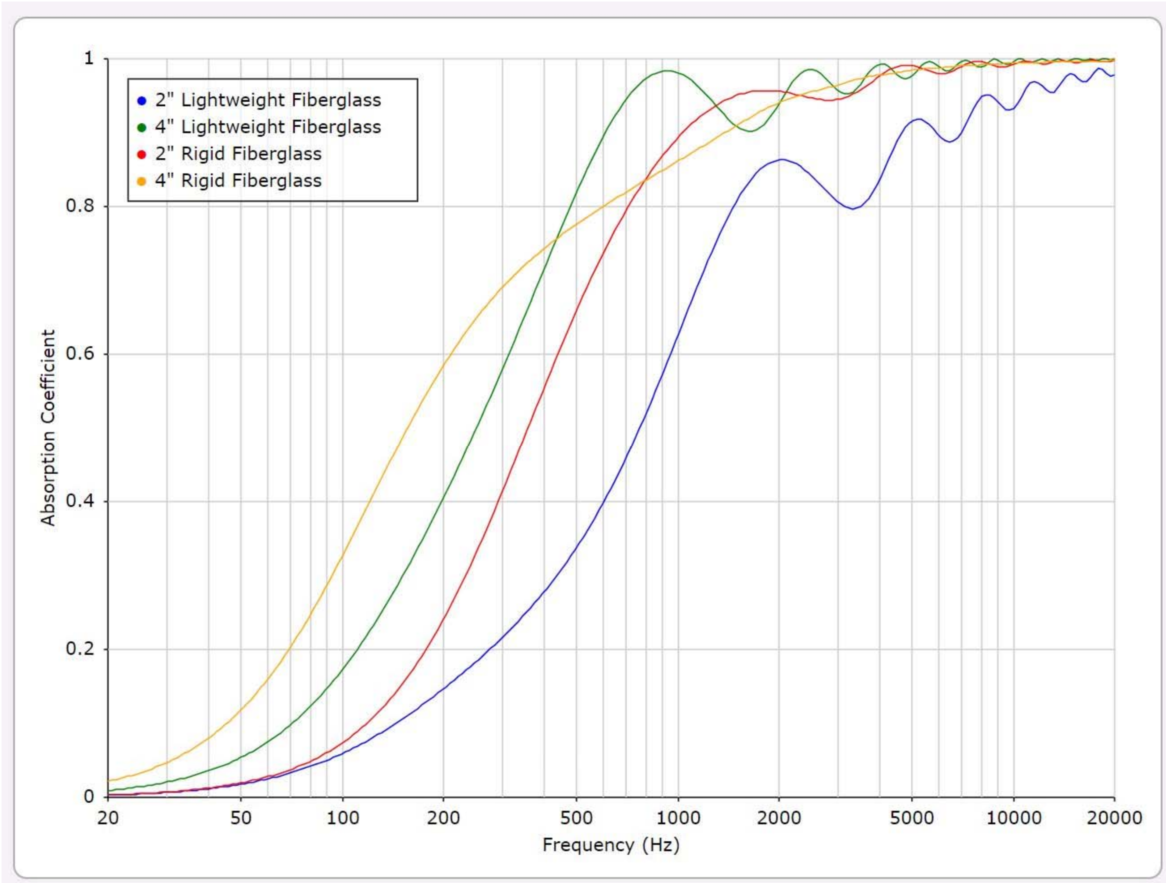
For lightweight fiberglass, the absorption has a smoother, more natural roll-off. As thickness increases so does the low-frequency absorption. i.e.; Owens Corning Pink (attic blanket)



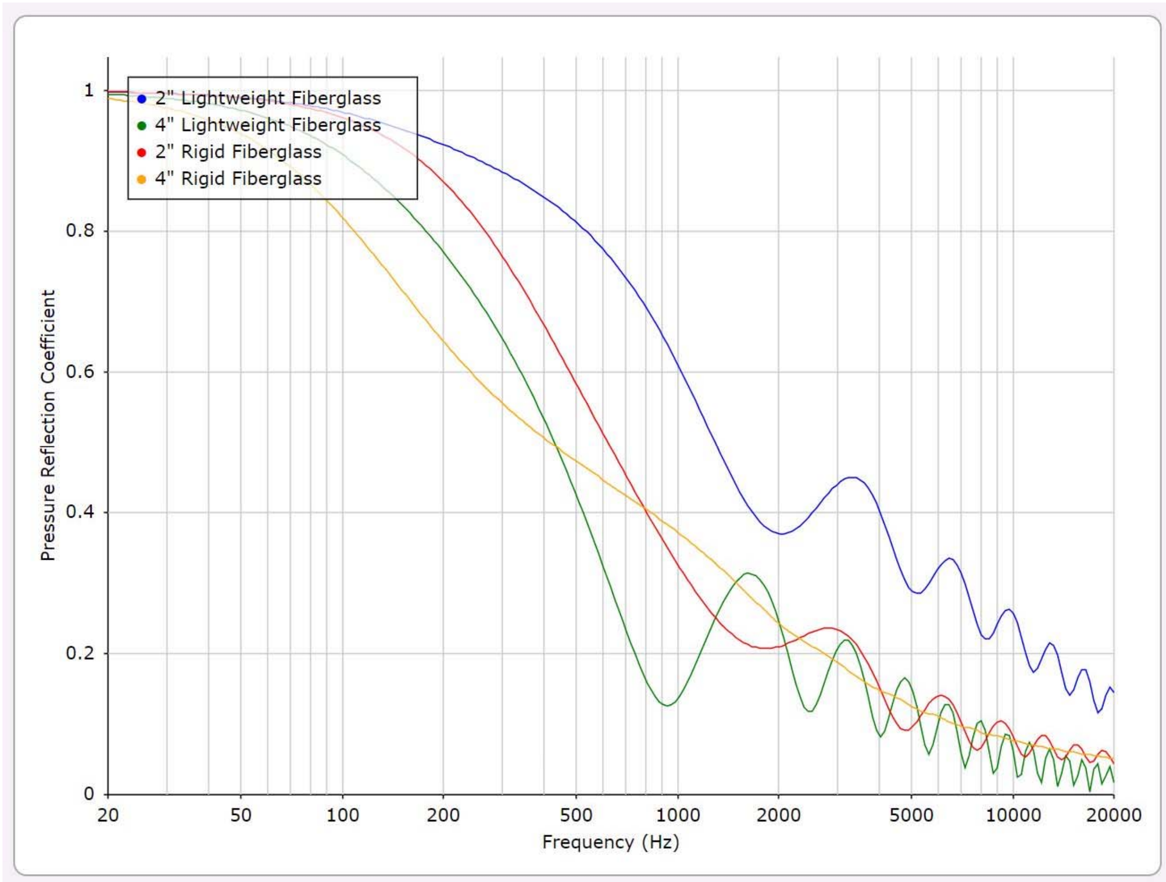
Thick Rigid Owens Corning 703 vs the Pink fluffy stuff - absorption. @ 0.7 Absorption Coefficient (-3.6 dB); 8” Lightweight - 150 Hz vs 8” Rigid – 400 Hz.



Thick Rigid Owens Corning 703 vs the Pink fluffy stuff – reflectivity.



Thin Rigid Owens Corning 703 vs the Pink fluffy stuff - absorption.



Thin Rigid Owens Corning 703 vs the Pink fluffy stuff – reflectivity.

Please see the document “Fluffy vs 703.pdf”

For more information contact me – john@jhbrandt.net