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REMARKS ON THE VOLUME OF REVERBERATION ROOMS TO BE USED FOR THE SOUND ABSORPTION MEASUREMENT

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UNDERLYING PROBLEMS ON THE ROOM VOLUME

For acoustic measurements in reverberation rooms, it is generally important to realize diffuse sound field in the room. It has been considered that several factors are closely related with the sound field in the room.

At low frequencies, the normal modes have been considered to be the predominant factor. From the well-known normal mode theory, the number of normal modes for certain frequency band increases in proportion to the volume of the room. The concept of Schroeder's limiting frequency would be considered to be the concluding guideline for the room volume. The necessary condition for room volume is given by the following formula, in relation with the lowest frequency of measurements f and the reverberation time T of the room (1).

$$V \geq 4 \times 10^6 T / f^2 \quad (1)$$

On the other hand, at high frequencies, the air absorption has been considered to be the important factor. By simple estimation, following condition should be fulfilled for the room volume.

$$V \leq \left(\frac{3\bar{\alpha}}{20 \cdot \Delta m} \right) \quad (2)$$

Here, $\bar{\alpha}$ is the average sound absorption coefficient of the room boundaries and Δm is the variation of sound attenuation constant per unit length corresponding to the variation of temperature and humidity. In order that the measurements might be carried out at frequencies up to 4000 Hz under the condition of $\bar{\alpha} = 0.02$ and $\Delta m = 0.001$, the room volume should be smaller than 30 cubic meters.

RECOMMENDATION ON THE VOLUME OF REVERBERATION ROOM

It would be extremely difficult to use only one reverberation room over the wide frequency regions, for example from 125 Hz to 4000 Hz. As the reasonable solution for this problem, it would be recommended to be used two or three reverberation rooms with different volume to a set of reverberation rooms is shown in Table 1.

Table 1 Recommended system of reverberation rooms

Frequencies (Hz)	125 ~ 315	400 ~ 1600	2000 ~ 4000
Volume (m ³)	1200	200	30

After adopting this set of reverberation rooms, some other problems will remain to be solved. These will be concerned with the so-called edge effect. It would be necessary to choose the optimum areas of test specimen for each reverberation room.

REFERENCE (1) Schroeder, M., *Acustica* (1954) 594