Room loudness = 10 $\log_{10}$ 10 = 10 db

If the sound absorption in the auditorium had been as small as 200 sabines, the sound intensity in the auditorium would have been 10 times as great and the noise level in the auditorium would have been 20 db.

If the rest of the auditorium has an area of 20,000 sq ft with a surrounding noise intensity of 50 db ($I'' = 10^5$) the noise level due to all of the noise entering through the wall would be found as follows:

$$\frac{I'}{I_0} = 10^5 \times 0.00001 = 1$$

$$\frac{I}{I_0} = 10 \text{ (Through equipment wall)} + 1 \times \frac{20{,}000}{2000} = 20$$

Room loudness × 10 $\log_{10}$ 20 = 13 db

Now suppose that there is also a duct having 20 sq ft outlet connecting the room with apparatus having a noise level of 70 db ($I'' = 10^7$) and suppose that there is an assumed attenuation in the duct equivalent to a transmission factor of 0.0002. Then,

$$\frac{I'}{I_0} = 10^7 \times 0.0002 = 2 \times 10^3$$

$$\frac{I}{I_0} = 20 \text{ (from above)} + 2 \times 10^3 \times \frac{20}{2000} = 40$$

Room loudness = 10 $\log_{10}$ 40 = 16 db

It may be seen how the energies of noises entering a room are added to obtain the final room noise intensity.

The average coefficients of sound transmission (128 to 4096 cycles) for a number of walls and of floor and ceiling partitions are listed in Table 3.

Table 3. Average Coefficients of Sound Transmission for Building Partitions[a]

Description of Partition	Average Coefficient
Brick panel, Mississippi, 8 in.; plastered both sides gypsum brown coat, smooth white finish; good workmanship	0.000010
Brick wall, 2½-in. plaster both sides	0.000032
Brick wall, 2½-in., 2-in. furring strips, ½-in. rigid insulation lath plastered both sides	0.0000016
Brick wall, 4 in., 2-in. furring strips and ½-in. rigid insulation lath, plaster, on one side; other side plastered directly on brick	0.0000040
Concrete flat slab floor construction, reinforced; floating floor consisting of nailing strips, rough and finish flooring; ½-in. rigid insulation furred out and applied as ceiling	0.0000020
Glass, plate ¼-in.	0.0010
Glass, plate ¼-in. double glazed, 1½-in. separation	0.0001
Metal lath, double, on 1½-in. channels, ¾-in. gypsum plaster; without cross bracing clips; 4 in., connected at edges only	0.000016
Tile, hollow clay partition, three cells, 4 in. x 12 in. x 12 in., wood furring strips, ½-in. rigid insulation, gypsum brown coat, smooth white finish	0.0000050
Wood joists, lower side plastered on wood lath; floating floor consisting of nailing strips, rough and finish flooring	0.0000050
Wood studs, two ½-in. sheets rigid insulation both sides, joints filled; gypsum scratch and brown coats, smooth white finish	0.000013
Wood studs, 2 in. x 4 in., staggered, metal lath, ½-in. gypsum plaster; 7½ in.; connected at edges only	0.000040

[a] *Architectural Acoustics*, by V. O. Knudsen, pp. 308-322.

LOCATION AND INSULATION OF EQUIPMENT ROOM

The equipment room, if possible, should be located at a considerable distance from all rooms in which quiet is required. If this is not possible, it is necessary to provide a high degree of insulation against the noise which may be transmitted through the walls of the equipment room, and also against the noise which almost certainly will be communicated through the short ducts. (See discussion of Control of Noise Transmission through Ducts, p. 337). Three wall sections and two floor and ceiling sections which are satisfactory for the wall insulation of the equipment room are shown in Fig. 2. Other partitions, with their sound insulating values, are listed in Table 3. The addition of absorptive materials (such as are described in Table 2) to the inner walls and ceiling

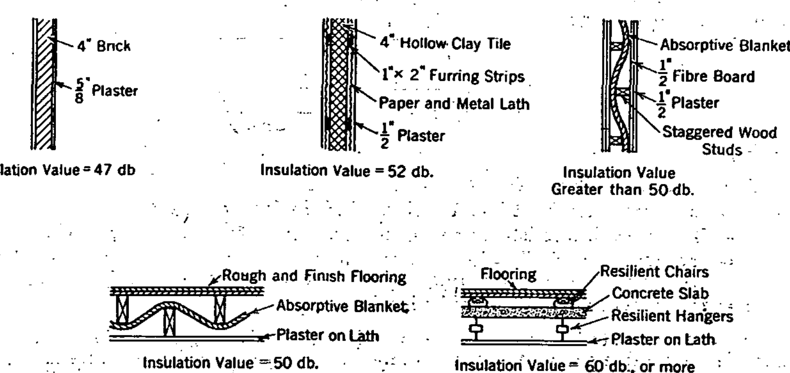

Fig. 2. Three Wall Sections and Two Floor and Ceiling Sections which are Suitable for the Insulation of Equipment Rooms[a]

[a] Acoustical Problems in the Heating and Ventilating of Buildings, by V. O. Knudsen (A.S.H.V.E. Transactions, Vol. 38, 1932).

of the equipment room will not only increase the insulation through the walls, but will also reduce the intensity of the noise in the room. The equipment room noise intensity may be figured in the same way as that of the conditioned space, taking the equipment as the source of noise. In case the equipment is subject to considerable vibration it is advisable to provide a separate or *floated* floor.

INSULATION OF MACHINERY AND SOLID-BORNE VIBRATION

Since mechanical vibrations are readily transmitted through the solid structure of a building, it is extremely important in air conditioning that all mechanical equipment in which vibrations are generated be thoroughly insulated from the solid structure of the building. An almost universal notion prevails that the vibrations generated by machinery can be insulated from a building simply by placing a slab of cork or a layer of hair felt between the machinery and the floor of the room. If the machinery is sufficiently heavy, and the cork or felt sufficiently resilient, this expedient may suffice. On the other hand, if the machinery is not sufficiently heavy to *load* the cork or felt support to the extent that the