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A-WEIGHTING, ADVANTAGES AND DISADVANTAGES WITH RESPECT TO IMPACT SOUND INSULATION MEASUREMENTS

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INTRODUCTION

The present conventional methods of impact sound insulation tests are based on the idea of limiting the impact sound generated by the standard impactor so as not to exeed the reference curve value at any frequency band. It is still necessary to discuss them from the following view points,

1) The need for short time measurements.
2) The present reference curve based on the impacts of hard hammers may not be applicable to the impacts of the low frequency impactor which simulates whole-body impacts.
3) Various cases which are rated to be an equal value are not necessarily of an equal condition to aural perception if a conventional spectral pattern is utilized to the reference curve as seen in the DIS 717.

Therefore, as one of the solutions, the measurement of the A-weighted sound level or the adoption of the inverse A-weighting curve has been recommended. In this paper, the problems concerned with the application of the L_A measurement to the impact sound insulation test will be discussed.

RELATIONSHIP BETWEEN L_A AND HUMAN PERCEPTION

Values of L_A and PL (after Stevens' MARK VII) were calculated assuming a model spectral pattern of impact sounds for various conditions in connection with actual cases. The value of L_C-L_A is supposed to be obtained from the readings of a sound level meter and it can be related to the horizontal position of a spectral pattern on the Freq.-SPL plane. According to those examinations, the following points are noted:

1) The A-weighting is the best among the weightings provid-

ed by conventional measuring equipments as it minimizes the scatter in the correlation between L_A and PL.
2) Within the range of 30 to 65 dBA a close relationship between L_A and PL is found, while out of that range, it becomes difficult to ignore the scatter.
3) As the scatter depends on the difference in the frequency at which the peak of the spectral pattern is observed, the correction can be made empirically by using the L_C-L_A

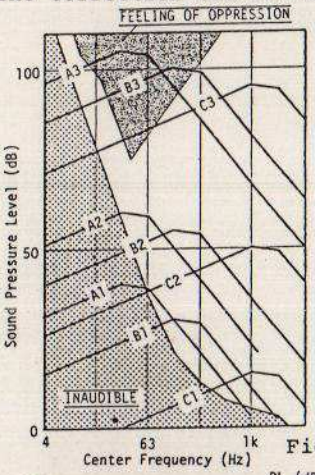


Fig.1

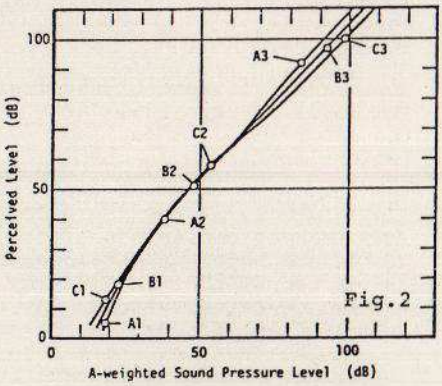


Fig.2

▼▲◆ Female walk with hard heeled shoes
☆ Drop of a rubber ball (reference)
● Male walk with leather shoes
○ Male walk with rubber shoes

----- Sound Level Meter B&K 2606 [impulse]
——— Sound Level Meter B&K 2606 [fast]
——— Level Recorder RION LR-03 [fast]

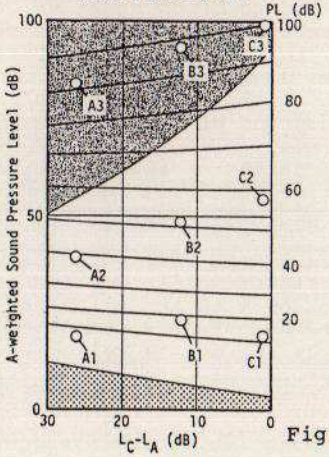
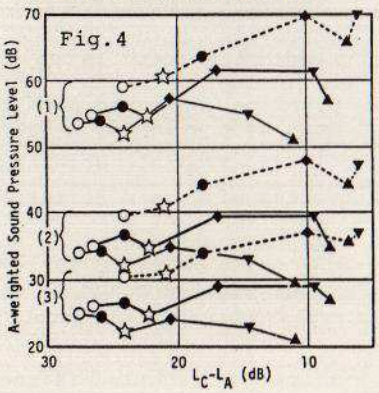


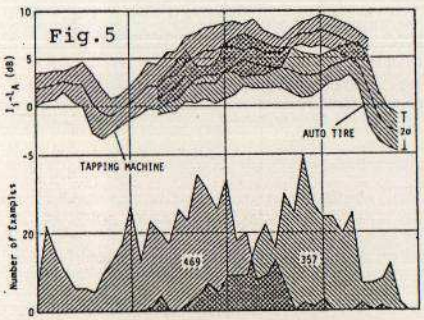
Fig.3

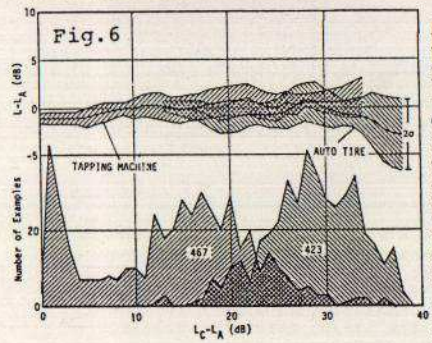


value.
4) The effect of the hearing threshold appears as a bend in each curve in Figure 2 below 40 dBA.
However, the experimental results in Figure 4 show that there still remain serious problems in carring out the measurement of real impact sounds. The L_A readings for each series of examples should be equal since they had been adjusted by listening tests. Actually in the case of a sound level meter, A-weighting does not represent the human response because of the larger reading values obtained from shorter impact durations.

RELATIONSHIP BETWEEN L_A AND EXISTING RATING VALUES

The basis of the L_A rating is quite different from that of the ISO rating for impact sound insulation tests. The relationship between L_A and I_i was investigated using data obtained from field measurements. As shown in Figure 5, L_A is difficult to be related directly to I_i. It should be pointed out, however, that the value of L_C-L_A makes it possible to find an empirical way to relate them. In the case of the Japanese Standard, the inverse A-weighting curve is adopted as the reference curve. The relationship between L_A and the Japanese rating number L is found to be very simple as shown in Figure 6.





ADVANTAGES OBTAINED BY AN ADDITIONAL VALUE OF L_C

As already shown in the previous figures, the value of L_C-L_A has an important role in analysing the properties of impact sounds. Therefore, a dual-figure rating method using L_A and L_C values is proposed. As shown in Figures 7 and 8, each spectrum corresponds to each point on the $L_A L_C$ plane, as the values of L_C and L_C-L_A can be related to the highest level of the spectrum and its frequency respectively. It

is quite enough to take only those two factors in order to specify the characteristics of the impact sound spectrum. It is interesting to note that the dual-figure rating using the measured values of L_A and L_C is considered to be equivalent to shift the appropriate reference curve not only upwards and downwards but also right and left towards the measured curve until they fit in. It should be emphasized that the disadvantages of the L_A rating method from losing the spectral information of impact sound can be compensated for by introducing the dual-figure rating method. Therefore, the imperfectness of the existing L_A measurements including the effect of the non-linear characteristics of hearing can be corrected by considering bending contour lines on the $L_A L_C$ plane.

ACKNOULEDGEMENTS

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Fig.7

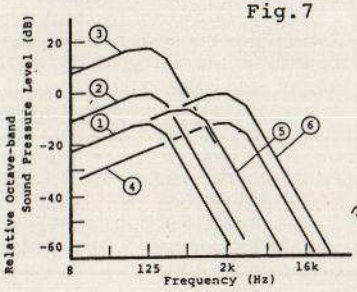
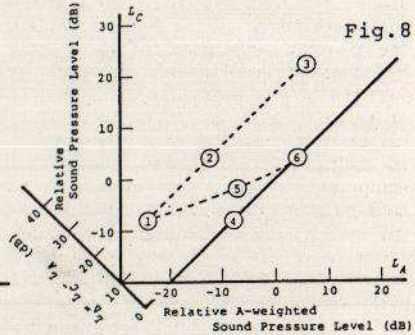


Fig.8



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