inter-noise 83

ON THE CONTROL OF NOISE EMISSION FROM HANDHELD IMPACT DRILLS

J. Asztély

National Board of Occupational Safety and Health, Research Department
Technical Unit, 171 84 Solna SWEDEN

INTRODUCTION

The aim of test methods concerning noise emission of machinery is in the long run to reduce the noise exposure of the operator. There are different ways to describe noise emission from machinery. As a specialist in acoustics you often find the total sound power of the machine complemented with directivety pattern as the ideal way of description. The user of the machine on the other hand wants for his purpose simple information about the noise level at his ear when using the machine. These and many other questions concerning running conditions at the test, the costs of the test, simulation of proper field situation during the test and so on complicate the work on a proper test method.

When working with an impact drill both the noise radiation from the machine itself including the electrical engine, gear and drill and the walls that are directly and indirectly excited by the drill have significance for the noise exposure in a typical working situation. The relative contribution of these sources may vary at different situations. Another question is what ear positions could be considered as typical when working with impact drills.

EAR POSITIONS

To find out what ear positions in relation to the machine, that was typical when using an electropneumatic impact drill, we studied the working positions at the same time as the sound level was recorded at the operator's ear next to the impact drill. Before starting this study we had, by using a dynamometer platform found out that the feeding thrust was not too critical to the noise emission. The operator spontanously used a feeding thrust suitable for the drilling operation that was relative constant.

At the field study we found that for the same working situation and the same operator the recorded sound level was fairly constant even if the working object and drill diameter was changed. Further we could divide the working operation into three main working situations, drilling upwards into the ceiling, forwards into a wall and downwards into a floor. When drilling upwards the left ear was kept beside the engine body. At the wall operation and floor operation the ear position relative to the engine body was roughly the same. Therefore for future measurements we standardized two microphone positions, one just beside the engine body, "ceiling" position and one "wall" position a bit further away from the engine body, see figure 1. Interviewing persons who worked with impact drills we got to know that the "wall" position was more frequent than "ceiling" position, still the "ceiling" position was interesting beceause of the significantly higher sound level.

NOISE RADIATION FROM THE EXCITED WALL WORKING WITH THE IMPACT DRILL

For the above standardized positions we wanted to get an idea to what extent the noise radiation from the excited wall contributed to the noise level at a field situation. The object where this investigations could be performed was a reconstruction site where a new door-opening was to be taken up in a 0.2 m thick concrete wall. To estimate the noise radiation from the wall sound intensity measurements with 2-microphone technique were performed. For the acoustic intensity measurements a B&K type 3519 intensity probe, a Nagra IV recorder and 2 channel HP 3682A FFT-analyzer with HP 9835 table computer were used. The acoustic intensity measurements were performed on the side facing opposite to the drilling side perpendicular to the wall. As can be seen in the diagram in figure 2 there is a peak in the intensity curve at appr. 8.5 kHz. The peak probably comes from a longitudinal standing wave in the concrete wall (the wave lengts λ = double the wall thickness 2 x 0.2 m). This intensity measurement was taken just behind the drilling hole. The average intensity radiating from the wall (10 m^2) was estimated to 90 dB(A) rel. 10^{-12} W. The noise level recorded at the "ceiling" position and the "wall" position were 100 resp. 91 dB(A).

The conclusion drawn from these measurements is that you cannot ignore how the impact drill excites the wall when studying the noise emission from it.

ESTIMATING THE SOUND POWER LEVEL FROM THE IMPACT DRILL

At these measurements we used our instrumentation for acoustic intensity measurements. The sound power level of the impact drill was determined both at free run and drilling into a concrete block. In figure 3 a and b the measurement surfaces are shown for the two cases. The measurements were performed in an ordinary room. In the loaded case a chipwood board was placed above the concrete block in order to separate the sound emission from the concrete block from the impact drill. In the table below the results expressed as A-weighted sound power level are given:

	L_W rel. 10^{-12}W
Machine at free run	94 dB(A)
Machine loaded	92 dB(A)
Concrete block	96 dB(A)

As can be seen from these measurements, the noise emission from the machine body becomes somewhat lower when the machine is loaded. The sound power level from the concrete block was greater than from the machine body. At appr. 2600 Hz the concrete block had a important resonance peak probably coming from vibrating in a torsional mode.

When performing the sound power measurements, the measurement variability between different measurements at free run were within 1 dB. It was noted that it was necessary to drive the machine warm before starting the measurements. For the loaded case determining the total sound power level was not very practical because you had to change drill hole several times during one measurement.

DISCUSSION

For future noise emission measurements on impact drills, a proper environment could be a laboratory for impact noise isolation measurements. An arrangement where the floor is isolated upwards should make it possible to separate the noise radiated from the machine body and the noise emitted by the excited wall structure. During the measurements the sound level should be recorded in positions corresponding to typical operator's ear positions.

A plate thickness of 0.15 m is suggested. In order to keep the costs for the test low the concrete area around the drilling hole must be arranged easily exchangable.

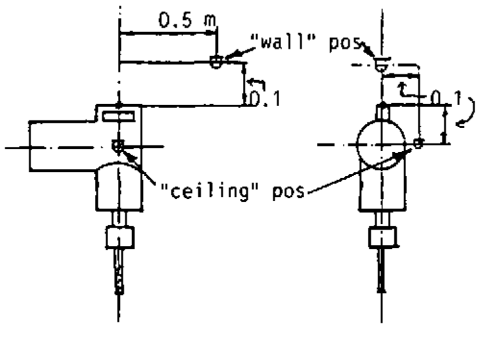

Figure 1. "Standardized" ear positions

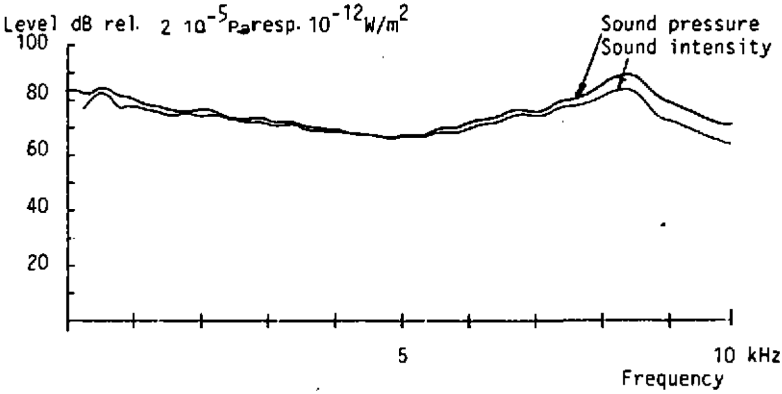

Figure 2. Intensity measurement taken just opposite the drilling-hole

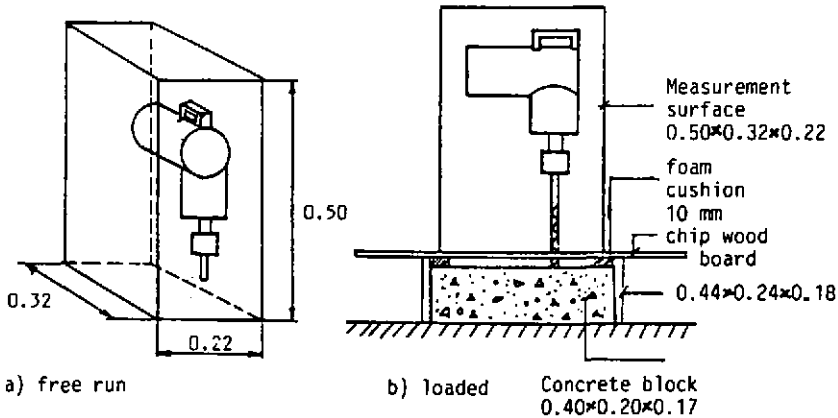

Figure 3. Measurement surfaces used during the sound power measurements