

VARIATION IN THE VIBRATION EMISSION OF ROTARY HAMMER DRILLS UNDER SIMULATED WORK-SITE CONDITIONS

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Introduction

Tool manufacturers are required to provide declarations of vibration emission values in order to sell their tools within Europe. To ensure that users can compare results obtained from different manufacturers, the declared values must be obtained using a methodology as specified in the relevant test code (such as in the ISO 8662 series of standards). In most cases, the vibration emission values obtained using test codes under-estimate the vibration that an operator will be exposed to when using the tool on a work-site. A further problem with manufacturers' data is that usually only a single value is provided for a tool. This is despite many factors affecting the vibration emission, including inserted tool type, work piece, operator technique, tool condition. New improved test codes are in the process of being developed.

In order to provide guidance to users on how to interpret manufacturers' data, a Draft CEN Technical Report (Draft CEN/TR 15350 (2005)) was developed. Part of the CEN/TR provides multiplication factors for combinations of task and tool type. For example, data obtained from electrical hammer drills (tested according to EN 60745-2-6:2003) should be multiplied by 2, for hammering applications, in order to obtain an estimate of the vibration emission during work.

In response to concerns from industry, the UK trade association OPERC have, in collaboration with hire companies and tool manufacturers, established a freely accessible online database of tool emission values based on independent tests carried out under simulated work-site conditions. This paper reports some of the data obtained from electrical hammer drills, highlighting the range of emission values that can be obtained for a tool. Data from many other tool types are also included in the database.

Methods

Tri-axial hand-arm vibration was measured at both handles of each of 19 electrical hammer drills, in accordance with ISO 5349-1 (2001). Each tool was measured with three experienced operators and at least 5 runs were completed for each operator. Tools were tested using a range of appropriate new bits from 4 to 40 mm diameter. The minimum number of bits for a tool was 3; the maximum number was 29. 146 tool / bit combinations are reported here, representing about 2200 individual 6-axis measurements. Operators were required to drill vertically into a concrete block with a compressive strength after 28 days of 40 N/mm². Two drills (1 and 15) were battery powered; others were powered using a 110V transformer supply.

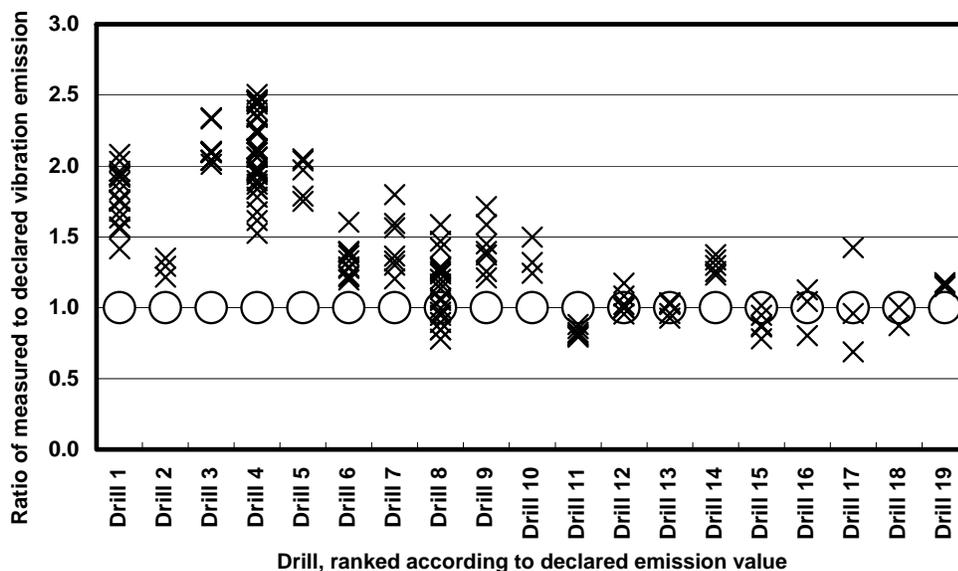


Fig 1. Ratio of measured emission to declared emission for 19 tools.

Results and Discussion

The relationship between the measured vibration and the declared vibration is illustrated in Fig 1. For those tools declaring vibration emission values less than 10 m/s² (Drills 1-10), work-site data were generally greater than declared values; for those tools declaring vibration emission values greater than 10 m/s² (Drills 11-19), work-site data were generally similar to declared values. Thus, if the scaling factors are used, those tools reporting higher but closer to simulated work-site values would be penalized.

In agreement with individual tool trends, there was a positive correlation between vibration emission and drill diameter (Fig 2, $p < 0.01$, Pearson). This indicates that provision of specific tool / bit data should improve applicability of risk assessments.

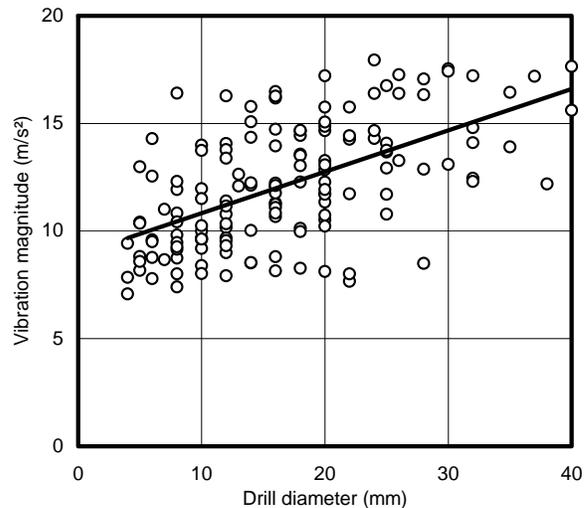


Fig 2. Relationship between drill diameter and vibration magnitude

Acknowledgements

Data in this abstract were drawn from the HAVTEC database (www.operc.com). The contributions of Dr David Edwards and Dr Andrew Rimell are acknowledged.

Reference

Draft CEN/TR 15350 (2005), *Mechanical vibration – Guideline for the assessment of exposure to hand-transmitted vibration using available information including that provided by manufacturers of machinery.*