

Focus on IFA's work

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Hand-arm vibrations: Measurement precision on hammering and turning machinery

Problem

The dominant measurement axis is no longer to be used when evaluating the vibration effects; instead, the vibration total value is used. The vibration total value is a combination of the measurements from all three spatial axes, it is being used in new European standards and regulations. Using the conventional measuring techniques on turning machinery, leads to systematic deviations due to the position of the measurement axes. In compressed air hammering machines, which call for the use of mechanical filters to avoid the measurement signal bias (DC shift), the cross-axis sensitivity of the filters leads to distortions in the measurement values due to "crosstalk". New measurement procedures had to be developed and validated.

Activities

In cooperation with the Health & Safety Laboratory (HSL) in England, comparison measurements were taken with conventional piezoelectric vibration transducers and with a LASER vibrometer, which works without physical contact. The tests were conducted in realistic but simulated working conditions in the laboratory due to the peculiarities of the LASER measuring technique.

Several representative types of grinders and pneumatic hammers (paving breakers) were studied. Tests included the difficult measurements on the chisel bit of pneumatic hammers at the point where the vibrations enter into the hand.



Comparison measurements of piezoelectric vibration transducers and a LASER vibrometer

Results and Application

The results indicated that the distance from the measurement axes of the pick-ups to the handle surface should be specified within narrow limits for rotating machinery. The provisions required as a result are to be included in CEN and ISO standardization of the emissions measurements. An automatic, quick and reproducible test procedure was developed to recognise measurement errors caused by DC shift.

Area of Application

All branches of commerce and industry, including testing bodies

Additional Information

- DIN EN ISO 5349: Mechanical vibration – Measurement and evaluation of human exposure to hand-transmitted vibration. Part 1: General requirements, Part 2: Practical guidance for measurement at the workplace (12.01). Beuth, Berlin 2001
- VDI 2057: Human exposure to mechanical vibrations. Sheet 2: Hand-arm vibrations (09.02). VDI, Düsseldorf 2002
- Directive 2006/42/EC of the European Parliament and of the Council of 17 May 2006 on machinery, and amending Directive 95/16/EC. OJ EC No. L157 of 9 June 2006, pp. 24-86, implemented in Germany as: 9th Ordinance under the German Product Safety Act of 12 May 1993, BGBl. I, p. 704, last amended by Article 19 G of 8 November 2011. BGBl. I (2011), p. 2178

- Directive 2002/44/EC of the European Parliament and the Council on the minimum health and safety requirements regarding the exposure of workers to the risks arising from physical agents (vibration). OJ EC No. L 177/13 of 6 July 2002, pp. 13-19
- Smeatham, D.; Kaulbars, U.; Hewitt, S.: Triaxial hand-arm vibration measurements on percussive machines – Problems and solutions. Lecture. 39th United Kingdom Group Meeting on Human Responses to Vibration, 15-17 September 2004, Ludlow, Shropshire, England www.dguv.de/webcode/m225774

Expert Assistance

IFA, Division 4: Ergonomics – Physical environmental factors

Literature Requests

IFA, Central Division