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Focus on IFA's work

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Whole-body vibration exposure: changes to the frequency weighting

Problem

The new edition of the VDI Guideline governing human exposure to mechanical vibrations (whole-body vibration) has adopted changes from international standards. The changes include widening of the frequency range from 1-80 Hz to 0.5-80 Hz, and within the new range, a change in the frequency weighting of the measured values for the vibration acceleration in the co-ordinate axes x, y, and z. These changes result in parameters which are either greater or smaller than those previously measured for the vibration exposure on the seats of vehicles and ride-on machines. In order for exposure data measured in the past to be suitable in future for use in hazard assessments and investigations of formal reports of occupational disease, conversion factors must be defined.

Activities

In response to an initiative by the former council of the German Social Accident Insurance Institutions for the building trade, existing records of vibration signals from vehicles and machinery upon which elevated exposure as defined in the hazard assessment may be expected were evaluated against both the former and the new frequency weightings, and mean conversion factors calculated from the results for the various vehicle types. The scope of the data, which formerly encompassed only a small number of vehicle types, was widened by further measurements and evaluation of them against the former and the new frequency weightings.

Wheel loader in quarrying service

Measurement results obtained by and available from the then Institution for Statutory Accidence Insurance and Prevention in the Mining Industry were also included.

Results and Application

The new frequency weighting is generally seen to produce the same or lower exposure values for the vertical, z-axis of vibration (the spinal axis for a seated person) on the majority of wheeled vehicles. For caterpillars, the new frequency weighting yields higher vibration values. For the horizontal axes of vibration, x and y, the exposure values generally increase, owing to the widening of the frequency range. The magnitude of the deviations in the measured vibration values is on the one hand typical for a given vehicle group; on the other, deviations also vary within a given vehicle group as a function of the mode of operation, mass distribution, and suspension characteristics of the vehicles and their components.

The mean correction factors for the vertical axis of vibration lie between 0.9 and 1.15 for the various vehicle types. This is relevant to occupational disease BK 2110. For the horizontal axis of vibration, the mean factors range from 1.0 to 1.2. These factors can be used to convert data recorded and evaluated in the past such that the new frequency weighting is observed.

Area of Application

All sectors of the economy with an industrial element

Additional Information

- VDI 2057-1: Human exposure to mechanical vibrations – Whole-body vibration (09.02). Beuth, Berlin 2002

- ISO 2631-1: Mechanical vibration and shock – Evaluation of human exposure to whole-body vibration – Part 1: General requirements (05.97). Beuth, Berlin 1997 (ISO 2631-1 AMD 1:2010)

- Further conversion factors in:
  Christ, E.; Fischer, S.; Kaulbars, U.; Sayn, D.: Effects of vibration at workplaces – Characteristic values of hand-arm and whole-body vibration. IFA Report 6/2006e. Published by: Institute for Occupational Safety and Health of the German Social Accident Insurance (IFA), Sankt Augustin 2010,
  www.dguv.de/webcode/e109328

Expert Assistance

IFA, Division 4: Ergonomics – Physical environmental factors

Literature Requests

IFA, Central Division

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