

NIOSH Evaluation of Riveting Hammer Hand-Transmitted Vibrations for Tinker Air Force Base

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Abstract

NIOSH's Physical Effects research Team (PERT) entered into a research collaboration with the U.S. Air Force 72nd Aerospace Medicine Squadron (72 AMDS) at Tinker Air Force Base (AFB) in Oklahoma. The Air Force identified Sheet Metal Mechanics as having a high risk of experiencing upper extremity ergonomic illnesses. It is presumed that a major ergonomic stressor for sheet metal mechanics is hand-transmitted vibration from powered hand tools such as riveting hammers. The 72 AMDS is interested in protecting its workers against potentially harmful exposures to hand-transmitted vibration (HTV) and in developing means to improve the process it uses in selecting powered hand tools for workers at Tinker AFB. One of the criteria 72 AMDS intends to use in the tool selection process is a ranking of prospective tools by vibration level. In an initial collaborative effort, the NIOSH group tested eight riveting hammer models supplied by 72 AMDS. NIOSH researchers employed six tool operators to run the tools against the loading device specified in the international standard for the measurement of tool handle vibrations (ISO 8662-2, 1992). NIOSH researchers rank-ordered the tools based on accelerations measured at the tool handle. Following the lab study, PERT suggested that the collaboration continue with a field study to evaluate riveting hammer vibration emissions during actual riveting tasks regularly performed by sheet metal mechanics at Tinker AFB. Three riveting tasks were identified by 72 AMDS for the field evaluation. Vibrations were evaluated based on the ISO 5349-1, 2001 and ANSI S2.70-2006 standards. Daily HTV exposures, or A(8) values, were also estimated for the Tinker AFB riveting hammer operators.

There were three major findings of this collaborative study: 1) Tools rankings were fairly consistent regardless of tool operator, work task, or acceleration weighting (ISO-weighted or unweighted). 2) Vibration magnitudes during the laboratory study were higher than those of the field study at Tinker AFB. However, the rank orders of the tools were fairly consistent, especially for the lower-vibration tools. This indicates that the ISO laboratory-based standard is appropriate for identifying tools that could be expected to exhibit lower vibrations in workplace environments. 3) None of the A(8) exposure estimations for the tools and tasks evaluated in this field study approach the ANSI S2.70-2006 Daily Exposure Action Value (DEAV) of 2.5 m/s².

Based on the study, PERT recommended that tool selection should not be based entirely on laboratory or field vibration measurements. Other criteria such as productivity, tool versatility, worker acceptance, initial cost, and maintenance costs should also be considered during tool selection.

It is important to note that rivet bucking bar vibration exposures were not evaluated in this study. It is likely that bucking bar hand-transmitted vibration exposures are considerably higher than exposures to riveting hammer operators. Unfortunately, there are no US or International standardized procedures for evaluating bucking bar vibrations, and there are several technical difficulties associated with bucking bar vibration measurements. Thus, bucking bar vibration measurement remains an important topic for future research.