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Focus on IFA's work

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Ergonomic analysis of grinding tasks in structural steel engineering

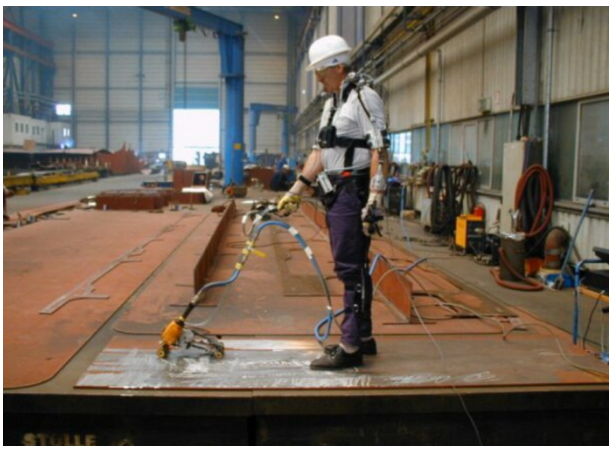
Problem

In structural steel engineering and specifically in the shipbuilding industry, large metal parts are welded together. In order for reliable welds to be produced, the weld region must be ground. A manually guided angle grinder is generally used for this purpose. Employees report that this task involves a high degree of stress upon the locomotor apparatus. In a member company of the then Metall-Berufsgenossenschaft (institution for statutory accident insurance and prevention in the metalworking industry), an ergonomic belt grinding machine (see bottom figure) was developed. This machine enabled grinding work to be performed by the operator walking upright, similar to operation of a lawnmower, and unfavourable postures therefore to be avoided.

The objective of this study was the comparative analysis of postures during work performed in the conventional manner and that performed with the modified ergonomic equipment design.

Activities

During performance of the two procedures in the plant, the postures were recorded at the usual workplace by means of the IFA's CUELA system for computer-aided measurement and long-term analysis of musculoskeletal load. The test subject was an experienced member of the plant's staff. The working situation was simulated, but corresponded to the usual stress situation.



Arrangement for ergonomic analysis during use of the conventional (top) and ergonomic (bottom) angle grinder

The measurement data were evaluated by means of the OWAS method (Ovako Working Posture Analysing System) and other methods.

Results and Application

Work performed with the conventional angle grinder was found to place a high degree of stress upon the locomotor apparatus. In particular, strong static bending of the spine occurred in conjunction with twisting of the trunk and a kneeling posture. By contrast, the use of the new tool substantially alleviated the stress; it enabled work to be performed for the most part in an upright posture. Significant components of bending and twisting of the trunk were not recorded.

The OWAS analysis revealed that during work performed with the angle grinder, no need for improvement in the work posture (OWAS action category 1) existed for only 9.1% of the working time, whereas the body postures assumed for 90.9% of the working time were classified as stressful, harmful or very harmful to the musculoskeletal system (OWAS action categories 2, 3 and 4). For the new grinding method involving the ergonomic belt grinder, 93.8% of the working time was classified as not harmful (OWAS action category 1); only 6.2% of the working time in this case was assigned to OWAS action category 2.

Besides reducing the stress, use of the ergonomic belt grinder was also shown to have considerable economic benefits. The time required for welding preparation work fell by almost half when it was used.

Area of Application

Structural steel engineering/shipbuilding

Additional Information

- Ellegast, R.P.: Berufsbezogene Belastungen des Stütz- und Bewegungsapparats – Objektivierung, Messung. 10.4.5, 35. Erg.-Lfg. 4/11. In: Handbuch der betriebsärztlichen Praxis. Ed.: Hofmann, F.; Kralj, N. ecomed Medizin, Landsberg/L. 2011 – loose-leaf edition

Expert Assistance

IFA, Division 4: Ergonomics – Physical environmental factors

German Institution for Social Accident Insurance in the woodworking and metal industry, Mainz

Literature Requests

IFA, Zentralbereich

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