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Ergonomics as element of process and production optimization

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Abstract

In view of the ongoing demographic change, working organizations of companies are faced with new requirements. The average duration of illnesses successively increases with the increasing age of the employees. In this context, about 25 percent of sick days are caused by musculoskeletal disorders. Diminishing work related strain can contribute to reducing the number of sick days. At Siemens, the topic „Ergonomics“ is promoted and taken to the factories throughout the world in close cooperation with the internal Process and Production Consulting department and the corporate Human Resources department. On factory level, consultants for ergonomics work directly together with the various stakeholders. Given that employees in production are well aware of any weak points at their work stations, involving them is the key to success. Through the interaction of all parties, sustainable ergonomic design measures are introduced and implemented. In its competence field „People in the Factory“, Production and Process Consulting of the Siemens AG deals with the human resource as an essential factor of success. In this context, ergonomics play a decisive role. Based on ergonomic expertise gained through specific trainings, experts apply scientifically validated assessment methods for analyzing and evaluating work stations. The methods are modular and comprise checklists for a preliminary rough analysis for identifying improvement potentials. Based on these results, tools for analyzing specifically demanding areas in more detail are occasionally being applied. Through ergonomic measures, a reduction of sick days seems to be possible. This also enables Siemens manufacturing departments to be equipped for the demographic change and to set up age-appropriate work stations. Currently, corporate departments offer two modules for support: ergonomics assessment including the implementation of optimization measures and train-the-trainer trainings for developing ergonomics experts at the specific locations. This lecture is about explaining and discussing experiences, problem areas and best practices.

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1. Overview of ergonomics assessments at Siemens

At Siemens different tools and checklists are used to assess ergonomic situations at workplaces. The toolbox includes a questionnaire on ergonomics for a first screening. Focuses at that screening are environmental circumstances like climate, noise, lighting or handling of hazardous materials including occupational safety.

Furthermore the so called Siemens-Ergonomics-Checklist is used. The Siemens-Ergonomics-Checklist is a rough screening method for identifying unfavorable loads in workplaces. The purpose of the checklist is to provide a method for performing a quick, initial evaluation of manual tasks at workstations in assembly areas or in similar workplaces and to provide an easy way of obtaining an overview of possible sources of strain. The following types of loads are evaluated [8]:

- Load handling,
- Tasks performed in unfavorable or forced postures and
- Tasks with high-energy or highly repetition, which can put loads on the finger, arm and hand regions.

The results of the evaluation using this method provide initial points of reference with regard to the design quality of the workplaces analyzed, and identify tasks that could pose a risk.

The third and most comprehensive checklist is the so called Siemens-Ergonomics-Tool. It is used for a detailed risk analysis and assessment of physical workloads for both the planning and the production phase. With regard to content, the procedure covers the following fields: posture, action forces of the arm-whole body system, and action forces of the hand-finger system, load manipulation and upper limb load in repetitive and short-lived tasks. Explaining the Siemens-Ergonomics-Tool in detail is main content of the following chapters.

2. Siemens-Ergonomics-Tools for detailed analysis of workplaces

The Siemens-Ergonomics-Tool is designed as a screening process for risk analysis and assessment of physical workloads for both the planning and the production phase, as specified in the EU directive on health and safety at work (89/391/EEC), as well as the EU Machinery Directive (orig. 89/392/EEC, 98/37/EC, 2006/42/EC).

2.1. Origin and framework for development of the tool

The complexity of the Siemens-Ergonomics-Tool means it can be used in all phases of a product creation process and enables cycles or work processes within a cycle, as well as an entire shift, to be assessed if they are identified as critical. The procedure enables work processes to be assessed in an early design phase and therefore complies with the requirements of the Occupational Health and Safety Act and the EU Machinery Directive (e.g. EN 614, EN 1005). The Siemens-Ergonomics-Tool can be used to enable clear risk assessment (in accordance with the Occupational Health and Safety Act).

The Siemens-Ergonomics-Tool enables physical workloads to be assessed in a screening process, which is based on a paper and pencil method and follows the recognized Ergonomic Assessment Worksheet (EAWS) procedure. This procedure is widely spread in the manufacturing sector and uses experiences collected during a development process spanning over ten years, which resulted in several forerunner procedures of the EAWS. These procedures have been proven over years of use in industrial practice and have helped to bring about a significant improvement in existing work situations. They guarantee legal compliance with regard to relevant EU directives (89/391/EEC [1], 90/269/EEC, 98/37/EC, 2006/42) in matters relating to physical workloads. The EAWS, and consequently also the Siemens-Ergonomics-Tool, was developed based on nationally and internationally recognized procedures and standards (EN 292, EN 614, EN 1050 [3], EN 894, EN 1005 and ISO 14121 [6], ISO 11226 [4], ISO 11228 [5]). They include four main categories:

1. EU framework directive 89/391/EEC [1] in addition to individual directives (in Germany, the Occupational Health and Safety Act along with relevant regulations)
2. EU Machinery Directive 98/37/EC [2], amended with 98/79/EC, along with relevant harmonized CEN and corresponding ISO standards (in Germany, the Product and Machine Safety Code)
3. Procedure of the Institute of Ergonomics at the Darmstadt University of Technology (IAD)
4. Internationally recognized procedures (e.g. NIOSH [12], OCRA)

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