

**prEN 1005-4: EVALUATION OF WORKING POSTURES IN RELATION TO MACHINERY**Nico Delleman<sup>A</sup>, Mark Boocock<sup>B</sup>, Bronislaw Kapitaniak<sup>C</sup>, Peter Schaefer<sup>D</sup>, and Karlheinz Schaub<sup>E</sup><sup>A</sup> TNO Human Factors, P.O. Box 23, 3769 ZG Soesterberg, The Netherlands (delleman@tm.tno.nl)<sup>B</sup> Health and Safety Laboratory, HSE, Broad Lane, Sheffield S3 7HQ, U.K.<sup>C</sup> Université PMC, Faculté de Médecine Pitié-Salpêtrière, Département de Physiologie, 91, boulevard de l'Hôpital, 75634 Paris Cedex 13, France<sup>D</sup> Technische Universität München, Lehrstuhl für Ergonomie, Boltzmannstrasse 15, 85747 Garching, Germany<sup>E</sup> Technische Universität Darmstadt, Institut für Arbeitswissenschaft, Petersenstrasse 30, 64287 Darmstadt, Germany

The authors constitute the writing group of CEN/TC122/WG4 for EN 1005-4.

This paper describes prEN 1005, the European standard on evaluation of working postures in relation to machinery. The scope, the status, and the risk assessment approach are described.

**INTRODUCTION**

About one-third of the workers in the European Union are involved in painful or tiring postures for more than half their working day, and close to 50% of the workers are exposed to short repetitive tasks, which most often go together with painful and tiring movements (European Foundation for the Improvement of Living and Working Conditions, 1996). Pain and fatigue may lead to musculoskeletal diseases, reduced productivity, and deteriorated posture and movement control. The latter can increase the risk of errors and may result in reduced quality and hazardous situations.

**SCOPE**

The European standard EN 1005-4 is intended to present guidance to the designer of machinery or its component parts in assessing and controlling health risks due to machine-related postures and movements, i.e. during assembly, installation, operation, adjustment, maintenance, cleaning, repair, transport, and dismantlement. The standard will specify recommendations for postures and movements without any or only with minimal external force exertion. The recommendations are primarily intended to reduce the risks for nearly all healthy adults, but could also have a positive effect on the quality, efficiency, and profitability of machine-related actions. The recommendations are based on current ergonomic knowledge, and are subject to changes according to future research.

**STATUS**

The standard is being prepared by Working group 4 'Biomechanics' of Technical Committee 122 'Ergonomics' of the European Committee for Standardization (CEN), under a mandate given to CEN by the Commission of the European Communities and the European Free Trade Association (EFTA). The standard supports essential health and safety requirements of the EU Machinery Directive (1989). All machines traded within the European Union are subject to this Directive. Compliance

with the standard provides one means of conforming with the specific essential requirements of the Directive and associated EFTA regulations. The prefix 'pr' (short for 'projet', which is French for 'draft') indicates the current status of EN 1005-4. Currently the draft standard is in the process of enquiry by the CEN members.

**RISK ASSESSMENT**

The standard provides guidance during the various design stages, and adopts a stepwise risk assessment approach, as described in EN 614-1, for assessing postures and movements as part of the machinery design process (refer to figure 1). The approach makes a distinction between:

- evaluation *without* users - when there is no full-size model/prototype of the machinery or its parts currently available.
- evaluation *with* users - when a full-size model/prototype of the machinery or its parts is available.

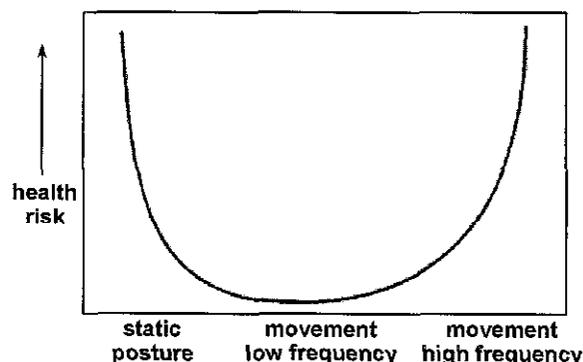


Figure 1. Flow chart illustrating the risk assessment approach

The risk assessment approach is based on the U-shaped model presented in figure 2, which proposes that health risks increase when the task approaches either end of the curve, i.e., if there is little or no movement (denoted static posture), or if movement frequencies are high. Concerning static postures, the risk assessment is a simplified version of the procedure described in ISO/FDIS 11226. Frequency-related risk assessment of movements is based upon Kilbom (1994).

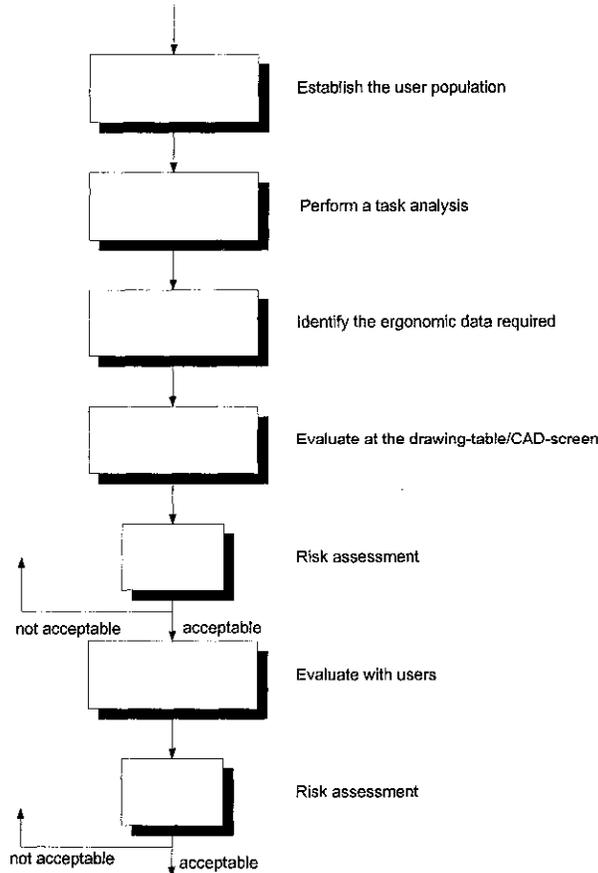


Figure 2. A model of the health risks associated with postures and movements.

Postures and movements are evaluated according to the following scheme:

- *acceptable*: the health risk is considered low or negligible for nearly all healthy adults; no action is needed.
- *conditionally acceptable*: there exists an increased health risk for the whole or part of the user population; the risk shall be analysed together with contributing risk factors, followed as soon as possible by reducing the risks (i.e. redesign) or if that is not possible, other suitable measures taken, for example user guidelines, to ensure that the use of the machine is acceptable.

- *not acceptable*: the health risk cannot be accepted for any part of the user population; redesign to improve the working posture.

For postures or movements observed that are assigned the outcome 'conditionally acceptable', a second step of the evaluation procedure is introduced. Acceptability may depend on the nature and duration of the posture and period of recovery, on the presence or absence of body support, or on the movement frequency. For static postures, reference to ISO/FDIS 11226 may be used as a guide.

**RELATIONSHIP TO OTHER STANDARDS**

In the early phases of design (figure 2), the standard refers to EN 614-1 and prEN ISO 14738. Concerning manual materials handling and force exertion in relation to machinery, the designer is referred to the parts 2 and 3 of prEN 1005.

**ACKNOWLEDGEMENTS**

The authors would like to recognise all those who have been involved in discussions during the drafting of this standard, particularly those of CEN/TC122/WG4.

**REFERENCES**

EN 614-1 (1995). Safety of machinery - Ergonomic design principles - Part 1: Terminology and general principles. Brussels, Belgium: CEN.

EU Machinery Directive (1989). Directive on the approximation of the laws of the Member States relating to machinery, 89/392/EEC (amended by Directive 91/368/EEC and Directive 93/44/EEC. Luxembourg: Office for Official Publications of the European Communities.

European Foundation for the Improvement of Living and Working Conditions (1996). Second European survey on working conditions. Luxembourg: Office for Official Publications of the European Communities.

ISO/FDIS 11226 (2000). Ergonomics - Evaluation of static working postures. Geneva, Switzerland: ISO.

Kilbom, Å. (1994). Repetitive work of the upper extremity: Part I - Guidelines for the practitioner, and Part II - The scientific basis (knowledge base) for the guide, International Journal of Industrial Ergonomics, 14, 51-57 and 59-86.

prEN ISO 14738 (1999), Safety of Machinery - Anthropometric requirements for the design of workplaces at machinery (ISO/FDIS 14738: 1999). Brussels, Belgium: CEN or Geneva, Switzerland: ISO.

prEN 1005-2 (1998). Safety of machinery - Human physical performance - Part 2: Manual handling of machinery and component parts of machinery. Brussels, Belgium: CEN.

prEN 1005-3 (1998). Safety of machinery - Human physical performance - Part 3: Recommended force limits for machinery operation. Brussels, Belgium: CEN.