TECHNICAL SPECIFICATION

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Ergonomic procedures for the improvement of local muscular workloads —

Part 1: Guidelines for reducing local muscular workloads

Procédures ergonomiques pour l'amélioration des charges de travail musculaire locales —

Partie 1: Lignes directrices pour réduire les charges de travail musculaire

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Foreword

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International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

In other circumstances, particularly when there is an urgent market requirement for such documents, a technical committee may decide to publish other types of normative document:

— an ISO Publicly Available Specification (ISO/PAS) represents an agreement between technical experts in an ISO working group and is accepted for publication if it is approved by more than 50 % of the members of the parent committee casting a vote;

— an ISO Technical Specification (ISO/TS) represents an agreement between the members of a technical committee and is accepted for publication if it is approved by 2/3 of the members of the committee casting a vote.

An ISO/PAS or ISO/TS is reviewed after three years in order to decide whether it will be confirmed for a further three years, revised to become an International Standard, or withdrawn. If the ISO/PAS or ISO/TS is confirmed, it is reviewed again after a further three years, at which time it must either be transformed into an International Standard or be withdrawn.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO/TS 20646-1 was prepared by Technical Committee ISO/TC 159, *Ergonomics*, Subcommittee SC 3, *Anthropometry and biomechanics*.

ISO/TS 20646 consists of the following parts, under the general title *Ergonomic procedures for the improvement of local muscular workloads*:

— *Part 1: Guidelines for reducing local muscular workloads*

— *Part 2: Practical use of the guidelines given in Part 1*

Introduction

The onset of work-related musculoskeletal disorders, such as lower-back pain and cumulative trauma disorders, is becoming a great ergonomic concern in both industrialised and industrialising countries. The high incidence of work-related musculoskeletal disorders is an important problem to be solved not only to improve workers' health and the quality of working life, but also to improve productivity.

In order to solve the problem of work-related musculoskeletal disorders, it is important to work out primary preventive measures, through improving working conditions and providing adequate health guidance and training, as well as to establish measures for secondary prevention, treatment, and reassignment of the workers after a long sick leave.

Above all, the establishment of primary preventive measures, mainly measures to reduce local muscular workloads (LMWL) is considered the most effective and economic solution, in the context of cost-efficiency as well as a better quality of working life. Various activities to reduce LMWL have already been promoted. In addition, regarding ISO/TC 159/SC 3, new standards are being prepared to improve working conditions relating to the factors causing LMWL. However, in order to reduce LMWL, it is indispensable to take a comprehensive work-related perspective and find a solution, in consideration of the aforementioned factors.

Ergonomic procedures for the improvement of local muscular workloads —

Part 1: Guidelines for reducing local muscular workloads

1 Scope

This part of ISO 20646 provides information and guidelines to properly utilise various ergonomics standards concerning the factors related to local muscular workload (LMWL), and helps develop activities to reduce LMWL in workplaces, in an effective and efficient manner. This part of ISO 20646 is intended primarily for employers, ergonomics and occupational health-related staff in enterprises, and workers. Specific measures to reduce LMWL can be applied to non-professional activities. Although this part of ISO 20646 provides ideas of effective and efficient measures to reduce LMWL, it does not certify the complete prevention of health problems caused by LMWL.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 11226, *Ergonomics — Evaluation of static working postures*

ISO 11228-1, *Ergonomics — Manual handling — Part 1: Lifting and carrying*

ISO 12100-1:2003, *Safety of machinery — Basic concepts, general principles for design — Part 1: Basic terminology, methodology*

ISO 14121, *Safety of machinery — Principles of risk assessment*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
local muscular workload
LMWL
loads on the musculoskeletal system required for working motions, maintaining working postures and exerting forces

3.2
harm
physical injury or damage to health

[ISO 12100-1:2003]

3.3
hazard
potential source of harm

[ISO 12100-1:2003]

3.4
risk
combination of the probability of occurrence of harm and the severity of that harm

[ISO 12100-1:2003]

3.5
risk assessment
overall process comprising a risk analysis, risk reduction measure and risk evaluation

NOTE Adapted from ISO 12100-1:2003.

3.6
risk analysis
combination of the specification of work situation, hazard identification and risk estimation

3.7
risk estimation
defining likely severity of harm and probability of its occurrence

[ISO 12100-1:2003]

3.8
risk evaluation
judgement, on the basis of successive risk analysis, of whether the risk reduction objectives have been achieved

[ISO 12100-1:2003]

3.9
work space
volume of space allocated to one or more persons in the work system to complete a work task

[ISO 9241-5:1998]

3.10
workstation
combination of work equipment for a particular person in a work space

[ISO 11064-2:2000]

NOTE It is possible that several persons share a particular workstation, or that several persons alternate between several workstations within any period of time (i.e. hourly, daily, weekly basis).

4 General guiding principles

4.1 Basic principles to reduce LMWL

The management should clarify existing and predicted LMWL, possible health- and productivity-related problems, and publish improvement goals and targets, a basic schedule to achieve the targets, and the organization to implement the improvement, in writing (see Annex A).

4.2 Basic framework and responsibilities of LMWL-reduction activities

As organizations draft, implement and assess LMWL-reduction plans, organizations at the enterprise level and department level, and advisory organizations, should develop activities in a collaborative manner.

4.2.1 Organization at the enterprise level

An organization to manage LMWL problems should be established at the enterprise level, either as part of existing management systems for work design or occupational safety and health, or as a specifically designated project activity. The owner or executive director with overall management authority shall be responsible for the establishment and the conduct of this organization.

4.2.2 Organization at the department level

This refers to an organization within an individual department, for which the departmental manager should be responsible. Its function is to draft, implement and assess the improvement plans for the department.

4.2.3 Advisory organization

This refers to an organization offering advice concerning the validity of drafting, implementation and assessment of improvement plans. The organization can be established inside or outside the enterprise.

4.3 Processes for LMWL risk assessment including implementation of risk reduction activity

An LMWL-reduction plan should not be limited to a few specific factors causing loads. It should be based on LMWL risk analysis in the workplace. On the basis of comprehensive risk assessment using this multi-factorial analysis, specific action targets should be set to eliminate or reduce unacceptable risks. Basic processes in achieving this target are given in 4.3.1 to 4.3.4 (see ISO 12100-1 and ISO 14121).

4.3.1 Risk analysis

To study the necessary activities to reduce the risks of increasing LMWL, risk assessment should be implemented on the basis of risk analysis. Risk analysis should be performed based on the results of specification of work situation, hazard identification and risk estimation.

Risk analysis should be completed by identifying priority risks that should be addressed immediately, so as to reduce risks or reinforce the on-going measures.

4.3.1.1 Specification of work situation

To study the characteristics of the work situation at the workplace, the following items should be specified.

a) Production process, contents of work and tasks to be performed at the workplace.

b) Statistics on occupational accidents, incidence of work-related diseases and other diseases, sick leave, etc.

c) Work organization and shift systems.

d) Work hours per day, week, month or year.

e) Operating time per day, continuous operating time and a rest system.

f) Characteristics of the workers, such as body size, muscle strength, history of injuries and diseases affecting work, work experience, vocational education and training, and age.

4.3.1.2 Hazard identification

The following factors are the main hazards for increasing LMWL (see Annex B).

4.3.1.2.1 Work hours and density

a) Long work hours.

b) Frequent and long overtime work.

c) Long continuous operating time.

d) Insufficient days off.

e) Uneven work density in a day, week, month or year.

f) Uneven work density between the workers.

4.3.1.2.2 Type of work

a) Lifting and carrying heavy objects (see ISO 11228-1).

b) Work requiring great physical force.

c) Repetitive monotonous work.

d) Work requiring frequent finger, hand or arm motions.

e) Work using vibrating tools.

f) Work with a keyboard or other data entry devices.

g) Precision work/work requiring high mental loads.

4.3.1.2.3 Postures and motions

a) Awkward postures and motions (see ISO 11226).

b) Continuous and/or highly frequent change in angle of joint (see ISO 11226).

c) Long-duration constrained posture (see ISO 11226).

d) Long-duration and/or long-distance walking (horizontal as well as on an inclining surface).

e) Frequent stair climbing.

4.3.1.2.4 Characteristics of work space and objects handled

a) Inadequate work space forcing an awkward posture or limited movement.

b) Layout of the workstation forcing excessive movement or awkward postures.

c) Inadequate height and dimensions of the work surface.

d) Handling work objects above the shoulder or below the knee.

e) Work space forcing the worker to maintain the same working posture.

f) Work objects which are heavy and/or require strong force.

g) Work objects which are difficult to hold or slippery.

h) Cold work environment and/or objects handled.

4.3.1.2.5 Premises

a) Slippery and/or uneven floor surface.

b) Noisy environment.

c) Whole body vibration.

4.3.1.3 Risk estimation

Risk estimation should take into account the severity of the harm and probability of its occurrence and the number of workers who will be affected.

4.3.2 Specifying risk reduction measures followed by a small trial of the improvement

To study the importance of risk factors and evaluate possible preventive measures for risk reduction, the following factors should be considered.

— Results of the risk analysis.

— Ease of implementation of the risk reduction plan.

— Effect of the improvement after reducing the risk.

— Number of workers who will benefit.

— Cost-efficiency of the plan.

Use of an action-oriented checklist is recommended to perform risk analysis, and to get hints for improvement (see Annex C). The recommended procedure for using the checklist is as follows.

a) Organize a group to implement a checklist practice. In the group, the owner or executive director with management authority, managers and workers of concerned sections, occupational health and safety personnel should be involved.

b) Define the workplace to be checked.

c) Fill out the checklist individually.

d) Organize small group discussions on the risk factors found at the workplace and the factors with priority of improvement.

e) Make an action plan to reduce risks for LMWL at the workplace.

f) Carry out a small trial to ensure the effect of the improvement before implementing the improvement on a large scale.

4.3.3 Implementation of risk reduction measures and monitoring of the effect of the activity

To check the effectiveness or insufficiency of the risk reduction measures, scheduled monitoring of the LMWL level and health problems of the concerned workers should be provided. It is recommended to check the subjective estimation of LMWL levels before and after the implementation, and subjective estimation of the effectiveness of the improvement after the implementation (see Annex D). Statistics of sick leave relating to LMWL and incidence of musculoskeletal diseases are also useful, to evaluate the effectiveness or insufficiency of the risk reduction measures.

