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Safety of machinery – Human physical performance – Part 3: Recommended force limits for machinery operation

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Denna standard ersätter SS-EN 1005-3, utgåva 1.

The European Standard EN 1005-3:2002+A1:2008 has the status of a Swedish Standard. This document contains the official English version of EN 1005-3:2002+A1:2008.

This standard supersedes the Swedish Standard SS-EN 1005-3, edition 1.

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EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

EN 1005-3:2002+A1

October 2008

ICS 13.110; 13.180

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English Version

Safety of machinery - Human physical performance - Part 3: Recommended force limits for machinery operation

Sécurité des machines - Performance physique humaine -
Partie 3: Limites des forces recommandées pour
l'utilisation de machines

Sicherheit von Maschinen - Menschliche körperliche
Leistung - Teil 3: Empfohlene Kraftgrenzen bei
Maschinenbetätigung

This European Standard was approved by CEN on 8 November 2001 and includes Amendment 1 approved by CEN on 18 August 2008.

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This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN Management Centre has the same status as the official versions.

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Foreword

This document (EN 1005-3:2002+A1:2008) has been prepared by Technical Committee CEN/TC 122 "Ergonomics", the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by April 2009, and conflicting national standards shall be withdrawn at the latest by December 2009.

This document includes Amendment 1, approved by CEN on 2008-08-18.

This document supersedes EN 1005-3:2002.

The start and finish of text introduced or altered by amendment is indicated in the text by tags $\boxed{A_1}$ $\boxed{A_1}$.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

$\boxed{A_1}$ For relationship with EU Directive(s), see informative Annexes ZA and ZB, which are integral parts of this document. $\boxed{A_1}$

EN 1005 consists of the following parts, under the general title "Safety of machinery - Human physical performance":

- Part 1: Terms and definitions;
- Part 2¹⁾: Manual handling of machinery and component parts of machinery;
- Part 3: Recommended force limits for machinery operation;
- Part 4¹⁾: Evaluation of working postures and movements in relation to machinery;
- Part 5¹⁾: Risk assessment for repetitive handling at high frequency.

Annexes A and B are for information only.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

¹⁾ This European Standard is under preparation by CEN/TC 122/WG 4 "Biomechanics".

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Introduction

Within the life cycle of a machine from construction to dismantling, various machine-related actions require muscular force exertion. Muscular force exertion causes strain to the musculo-skeletal system. Unfavourable musculo-skeletal strain corresponds to the risk of fatigue, discomfort and musculo-skeletal disorders. The manufacturer of a machine is in a position to control these health risks by optimising the required forces, while taking into account the frequency, duration and variation of force exertion.

The calculation procedure and the recommended limits in this standard aim to reduce the health risk for the operator as well as to increase the flexibility and possibility for a larger population to operate the machines which increases efficiency and profitability.

This standard has been prepared to be harmonised standard in the sense of the Machinery Directive and associated EFTA regulations.

This standard is written in conformity with EN 1050 and gives the user hazard identification for harm through musculo-skeletal disorders and tools for qualitative and, to an extent, a quantitative risk assessment. The tools for the risk assessment also implicate how to do the risk reduction. This standard does not deal with risks connected to accidents.

The recommendations provided by this standard are based on available scientific evidence concerning the physiology and epidemiology of manual work. The knowledge is, however, scarce and the suggested limits are subject to changes according to future research. In accordance with the rules for CEN/CENELEC-standards Part 2, 4.9.3, European Standards are reviewed at intervals not exceeding five years.

This European Standard is a type B standard as stated in EN 1070.

The provisions of this document can be supplemented or modified by a type C standard.

NOTE For machines which are covered by the scope of a type C standard and which have been designed and built according to the provisions of that standard, the provisions of that type C standard take precedence over the provisions of this type B standard.

1 Scope

This European Standard presents guidance to the manufacturer of machinery or its component parts and the writer of C-standards in controlling health risks due to machine-related muscular force exertion.

This standard specifies recommended force limits for actions during machinery operation including construction, transport and commissioning (assembly, installation, adjustment), use (operation, cleaning, fault finding, maintenance, setting, teaching or process changeover) decommissioning, disposal and dismantling. The standard applies primarily to machines which are manufactured after the date of issue of the standard.

This standard applies on one hand to machinery for professional use operated by the adult working population, who are healthy workers with ordinary physical capacity, and on the other hand to machinery for domestic use operated by the whole population including youth and old people.

The recommendations are derived from research on European population.

This document is not applicable to specify the machinery which are manufactured before the date of publication of this document by CEN.

2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

EN 614-1, *Safety of machinery - Ergonomic design principles - Part 1: Terminology and general principles*.

EN 1005-1:2001, *Safety of machinery - Human physical performance - Part 1: Terms and definitions*.

EN 1070, *Safety of machinery – Terminology*.

3 Terms and definitions

For the purposes of this European Standard, the terms and definitions given in EN 614-1, EN 1005-1:2001 and EN 1070 apply.

4 Recommendations

4.1 General recommendations and information

The manufacturer should first consider EN 292-2:1991, annex A and EN 614-1 and EN 614-2 and then use the procedure for determining force limits presented below.

It is crucially important that the operator is in control of the operation sequences and the pace of the machinery. Furthermore, machines shall be designed in a way so that actions demanding force exertion can be performed optimally with respect to the posture of body and limbs and the direction of force application. In addition machines shall be designed to allow for variations in movements and force exertions.

The risk assessment procedure conveyed by this standard should formally be carried out for each action occurring during handling of the machinery. It may be noted, however, that infrequently occurring actions with low force demands may be assessed on an overview base.

Actions related to the handling of control actuators are considered in EN 894-3, however the present standard provides additional important information related to physical capacity and safety of the operator.

4.2 Risk assessment of action forces

The risk assessment in the present standard is based on the force generating capacity of the intended users, and follows a three-step procedure as illustrated in Figure 1.

In step A, the maximal isometric force generating capacity is determined for relevant actions within specified intended user populations. Within the scope of this standard the determination of maximal forces can be carried out according to three alternative methods.

In step B, the force generating in step A capacity is reduced, according to the circumstances under which the force is to be generated (velocity, frequency and duration of action). The reduction is achieved by a set of multipliers. Basically, the output is a force that may be delivered without substantial fatigue.

In step C, the risk associated with the intended use of the machinery is assessed. The risk evaluation is accomplished using risk multipliers, reducing the maximal attainable force from step B to values associated with different levels of risk.

The risk assessment focuses on musculo-skeletal disorders, and is preferentially based on the assumption that decreasing fatigue during work is effective in reducing disorders.

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The recommended force limits are applicable to most men and women in a general population in optimal action posture and under ideal circumstances. The limits are calculated for an optimal range of motion of the joints involved in the respective actions.

It is recommended to let force limits for professional users correspond to the 15th percentile of the whole adult population, i.e. males and females between 20 years and 65 years of age. Force limits for machines intended for domestic use should correspond to the 1st percentile of the same adult population. The adult population is used as reference since reliable force data are scarce or unavailable for youth and aged individuals. Limits established by the procedure in this standard will essentially reduce hazards for at least 85 % of the intended user population.

The manufacturer should be aware that the force evaluation presented by the standard may be used also as a guidance when making instructions for the use of the machinery.

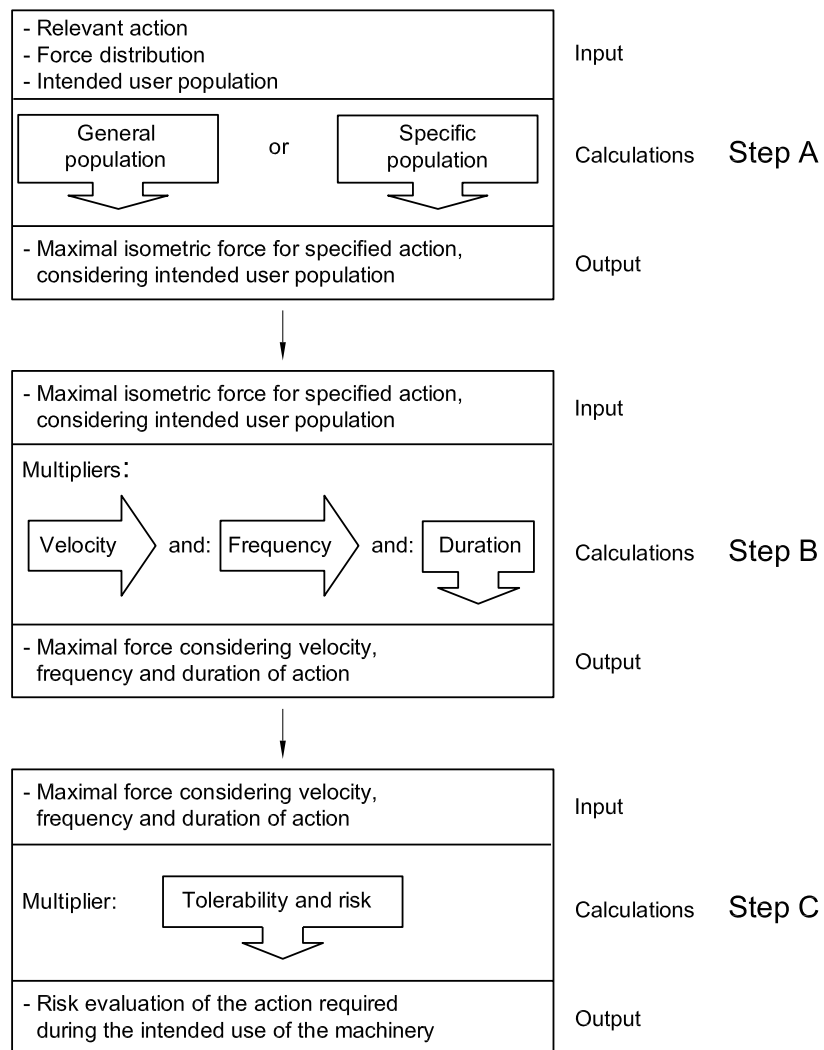


Figure 1 — Illustration of the step procedure leading to risk evaluation of action forces during machinery use for specified intended user populations