IFA
Institut für Arbeitsschutz der
Deutschen Gesetzlichen Unfallversicherung

Human Factors and Ergonomics in harmonised standardisation and the revision of EN 614-1

Peter Nickel

EUR-Lex

cen
EUROPEAN COMMITTEE FOR STANDARDIZATION

Summer University Ergonomics,
Hungarian Ergonomics Society (MET), Gyöngyös, July 3-5, 2024

[https://eur-lex.europa.eu/homepage.html
https://www.cencenelec.eu/about-cen/]

Agenda

- HFE and 614-1, why and when?
- The Treaty of Lisbon treats Directives
- From Directive to Regulation
- Standards, OSH and Harmonisation
- Essential Health & Safety Requirements and Ergonomic Design Principles
- Mental Abilities, Human-System Interaction, User Expectations, Automation

[By Matti Blume, Detail of a portainer at Containerterminal Burchardkai, Hamburg, 2019, CC BY-SA 4.0, via WikiMediaCommons]

Guidance for the application of ergonomics standards in the design of machinery

- EN 13861:2011 – Safety of Machinery …
- Application of standards in the design process
- Risk assessment according to EN ISO 12100
  - limits of machinery regarding ergonomics
  - identification of ergonomics related hazards
- ABC types of standards
  - search, selection, application
  - alternative measures / procedures
- Risk reduction
- Application of EN 614-1
  - C type standard is not available
  - C type standard does not cover issue

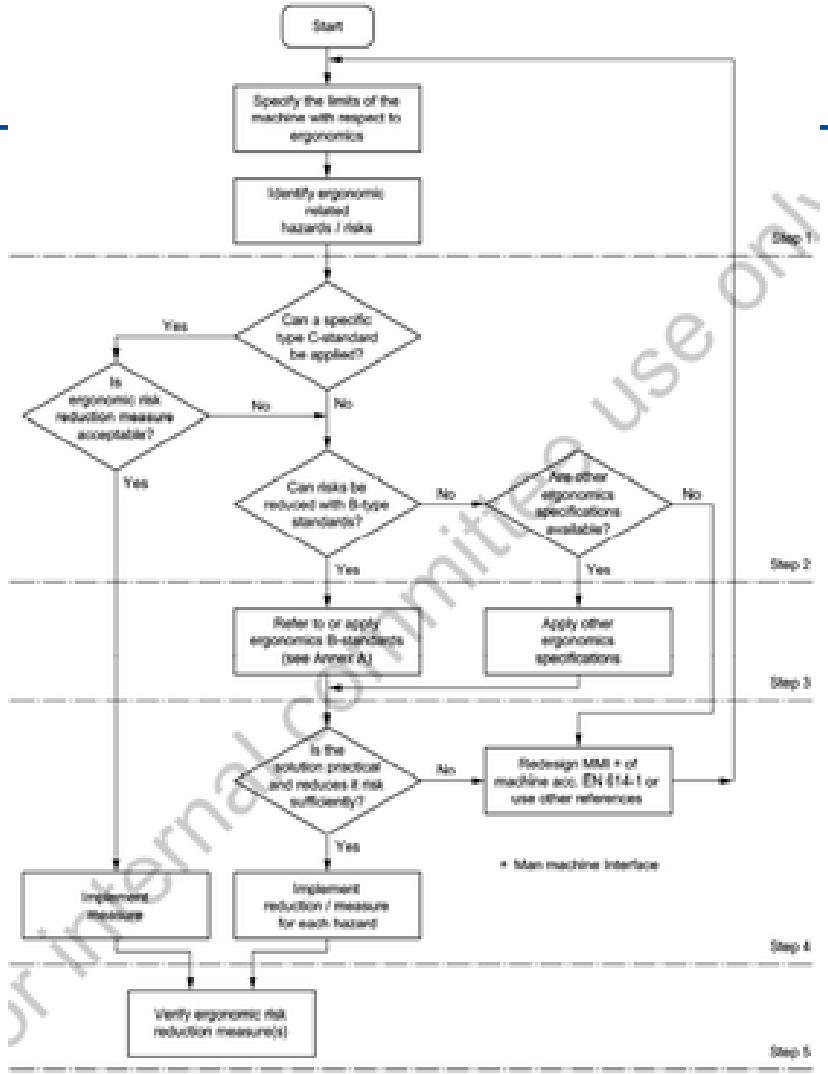
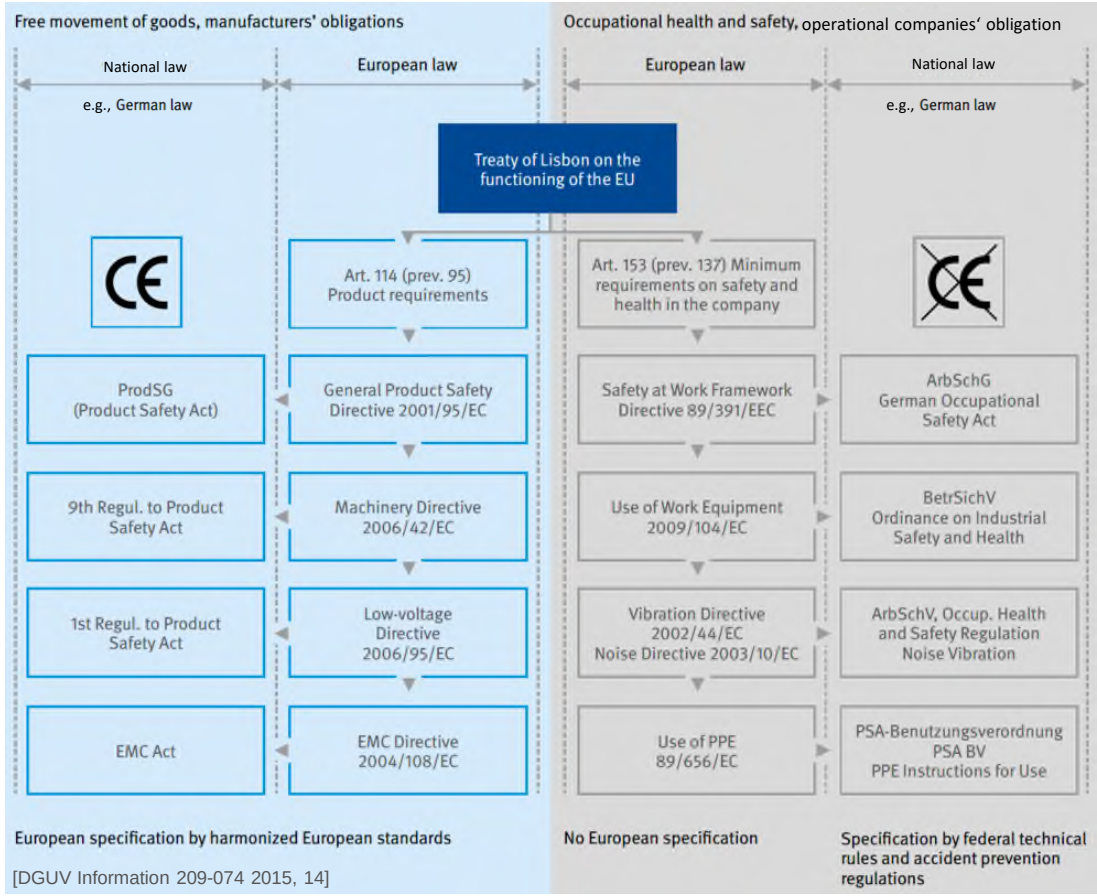


Figure 1 — Flowchart of the step model

Organisation of OSH in the EU

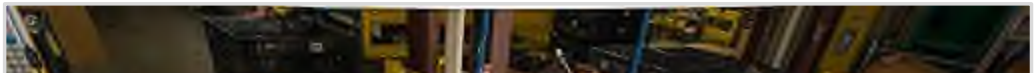
- Treaty of Lisbon
- Article 153
  - Minimum requirements on OSH in company
  - OSH Framework Directive 89/391/EEC etc.
  - risk assessment refers to human jobs
  - OSH for worker population
- Article 114 CE
  - Product safety requirements for use in EU
  - Machinery Directive 2006/42/EC etc.
  - risk assessment refers to human tasks
  - free exchange of products within EU, but market protection towards EU



[DGUV Information 209-074 2015, 14]

OSH Framework Directive 89/391/EEC

- Risk assessment refers to human jobs



The objective of this Directive is
to introduce measures to encourage improvements
in the safety and health of workers at work.
…
The employer shall combat, the worker shall
…

[By Jeff Green/Rethink Robotics, Collaborative robot Sawyer on the factory floor at Tennplasco in Lafayette, TN, CC BY 4.0, via Wikimedia Commons]

COUNCIL DIRECTIVE

of 12 June 1989

on the introduction of measures to encourage improvements in the safety and health of workers at work

(89/391/EEC)

SECTION I

GENERAL PROVISIONS

Article 1

Object

1. The object of this Directive is to introduce measures to encourage improvements in the safety and health of workers at work.
2. To that end it contains general principles concerning the prevention of occupational risks, the protection of safety and health, the elimination of risk and accident factors, the informing, consultation, balanced participation in accordance with national laws and/ or practices and training of workers and their representatives, as well as general guidelines for the implementation of the said principles.
3. This Directive shall be without prejudice to existing or future national and Community provisions which are more favourable to protection of the safety and health of workers at work.

…

Article 6

General obligations on employers

1. Within the context of his responsibilities, the employer shall take the measures necessary for the safety and health protection of workers, including prevention of occupational risks and provision of information and training, as well as provision of the necessary organization and means.

The employer shall be alert to the need to adjust these measures to take account of changing circumstances and aim to improve existing situations.

2. The employer shall implement the measures referred to in the first subparagraph of paragraph 1 on the basis of the following general principles of prevention:

(a) avoiding risks;

(b) evaluating the risks which cannot be avoided:

(c) combating the risks at source;

(d) adapting the work to the individual, especially as regards the design of work places, the choice of work equipment and the choice of working and

…

[https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=celex%3A31989L0391]

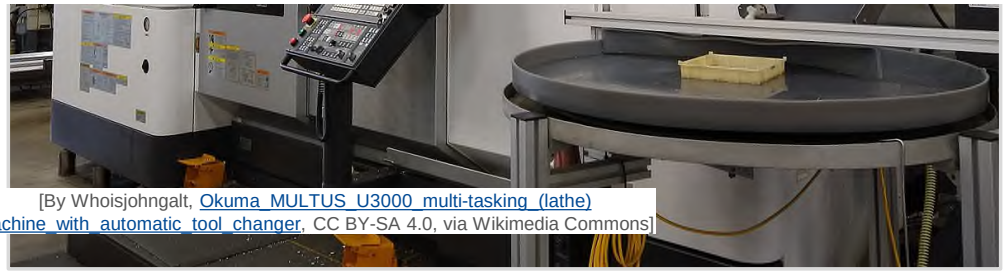
Machinery Directive 2006/42/EC

- Risk assessment refers to human tasks

…

Before placing machinery
on the market and/or putting it into service,
the manufacturer or his authorised representative
shall: (a) ensure that it satisfies
the relevant essential health and safety requirements
set out in Annex I;

…



[By Whoisjohngalt, Okuma_MULTUS_U3000_multi-tasking_(lathe)_machine_with_automatic_tool_changer, CC BY-SA 4.0, via Wikimedia Commons]

DIRECTIVE 2006/42/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL

of 17 May 2006

on machinery, and amending Directive 95/16/EC (recast)

(Text with EEA relevance)

Article 1

Scope

1. This Directive applies to the following products:

(a) machinery;

(b) interchangeable equipment;

(c) safety components;

…

Article 5

Placing on the market and putting into service

1. Before placing machinery on the market and/or putting it into service, the manufacturer or his authorised representative shall:

(a) ensure that it satisfies the relevant essential health and safety requirements set out in Annex I;

(b) ensure that the technical file referred to in Annex VII, part A is available;

(c) provide, in particular, the necessary information, such as instructions;

(d) carry out the appropriate procedures for assessing conformity in accordance with Article 12;

(e) draw up the EC declaration of conformity in accordance with Annex II, part 1, Section A and ensure that it accompanies the machinery;

(f) affix the CE marking in accordance with Article 16.

…

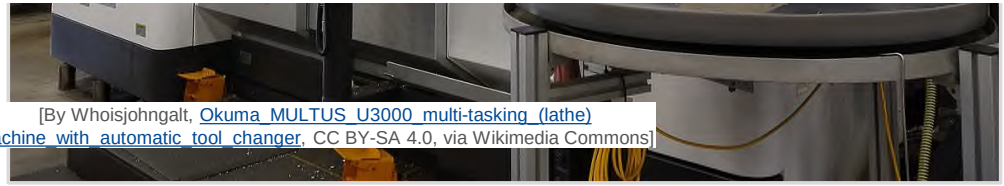
[http://data.europa.eu/eli/dir/2006/42/2019-07-26]

effective from 2027
without transition period

Machinery Regulation (EU) 1230/2023

- Risk assessment refers to human tasks

This Regulation lays down health and safety requirements for the design and construction of machinery, related products and partly completed machinery
to allow them to be made available on the market or put into service
while ensuring a high level of protection of the health and safety of persons, in particular consumers and professional users … .



[By Whoisjohngalt, Okuma_MULTUS_U3000_multi-tasking_(lathe)_machine_with_automatic_tool_changer, CC BY-SA 4.0, via Wikimedia Commons]

REGULATION (EU) 2023/1230 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL

of 14 June 2023

on machinery and repealing Directive 2006/42/EC of the European Parliament and of the Council and Council Directive 73/361/EEC

(Text with EEA relevance)

CHAPTER I

GENERAL PROVISIONS

Article 1

Subject matter

This Regulation lays down health and safety requirements for the design and construction of machinery, related products and partly completed machinery to allow them to be made available on the market or put into service while ensuring a high level of protection of the health and safety of persons, in particular consumers and professional users, and, where appropriate, of domestic animals and property, and, where applicable, of the environment. It also establishes rules on the free movement of products within the scope of this Regulation in the Union.

Article 2

Scope

1. This Regulation applies to machinery and the following related products:

(a) interchangeable equipment;

(b) safety components;

(c) lifting accessories;

…

Article 8

Essential health and safety requirements for products within the scope of this Regulation

Machinery or related products shall only be made available on the market or put into service if, where properly installed and maintained and used for their intended use or under conditions which can reasonably be foreseen, they meet the essential health and safety requirements set out in Annex III.

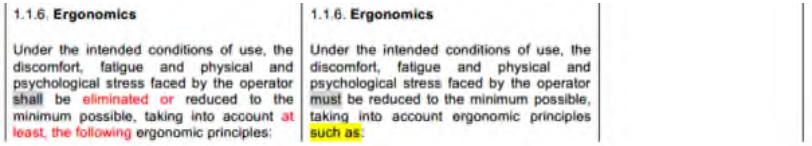
Partly completed machinery shall only be made available on the market if it meets the relevant essential health and safety requirements set out in Annex III.

…

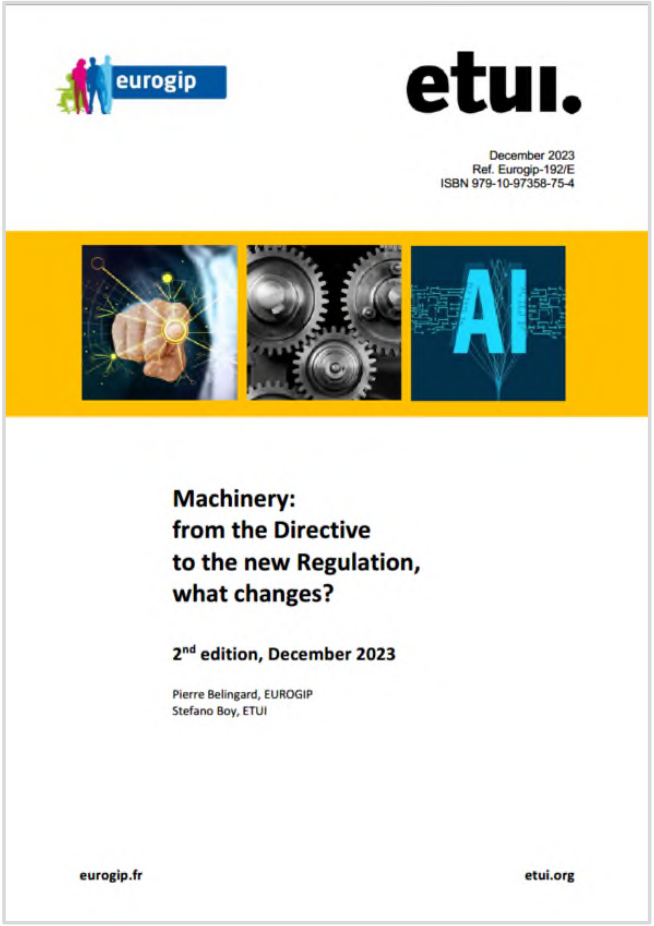
[http://data.europa.eu/eli/reg/2023/1230/2023-06-29]

Differences between Machinery Directive & Machinery Regulation

https://eurogip.fr/wp-content/uploads/2024/01/EN-EUROGIP-ETUI_Machinery-from-the-Directive-to-the-new-Regulation-V2-2023-12.pdf



1.1.6. **Ergonomics**	1.1.6. **Ergonomics**
Under the intended conditions of use, the discomfort, fatigue and physical and psychological stress faced by the operator shall be eliminated or reduced to the minimum possible, taking into account at least the following ergonomic principles:	Under the intended conditions of use, the discomfort, fatigue and physical and psychological stress faced by the operator must be reduced to the minimum possible, taking into account ergonomic principles such as:



eurogip

etui.

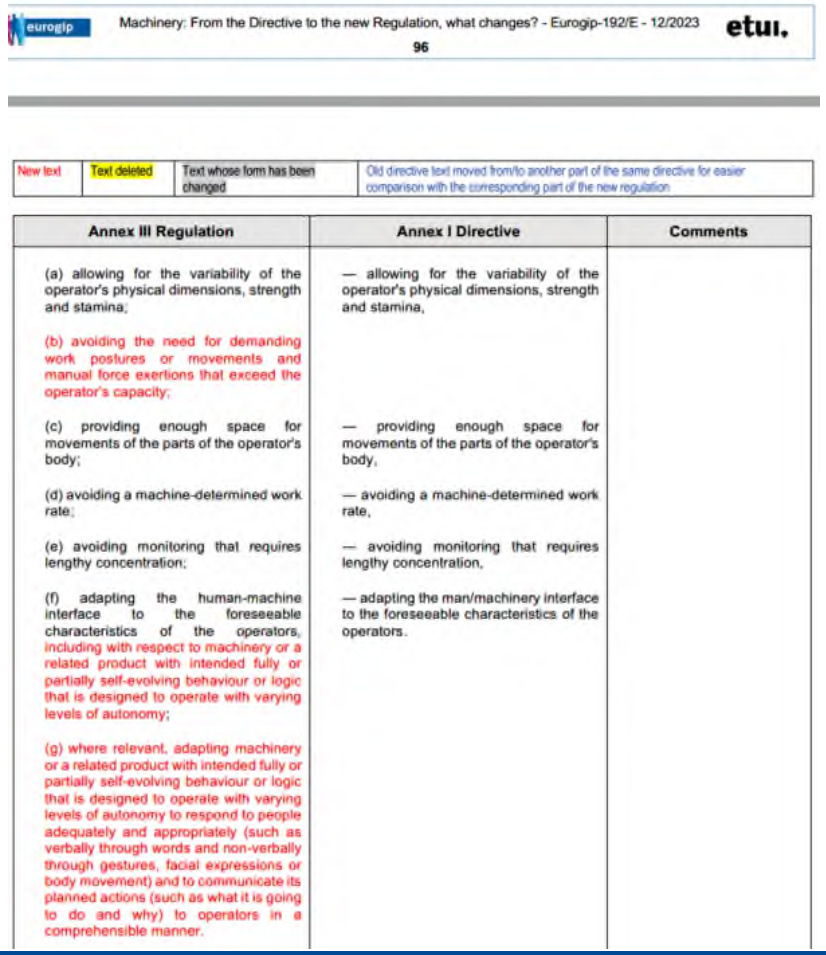
December 2023
Ref. Eurogip-192/E
ISBN 979-10-97358-75-4

Machinery: from the Directive to the new Regulation, what changes?

2nd edition, December 2023

Pierre Belingard, EUROGIP
Stefano Boy, ETUI

eurogip.fr etui.org



eurogip Machinery: From the Directive to the new Regulation, what changes? - Eurogip-192/E - 12/2023 etui.

96

New text	Text deleted	Text whose form has been changed	Old directive text moved from/to another part of the same directive for easier comparison with the corresponding part of the new regulation

Annex III Regulation	Annex I Directive	Comments
(a) allowing for the variability of the operator's physical dimensions, strength and stamina;	— allowing for the variability of the operator's physical dimensions, strength and stamina,	
(b) avoiding the need for demanding work postures or movements and manual force exertions that exceed the operator's capacity;		
(c) providing enough space for movements of the parts of the operator's body;	— providing enough space for movements of the parts of the operator's body,	
(d) avoiding a machine-determined work rate;	— avoiding a machine-determined work rate,	
(e) avoiding monitoring that requires lengthy concentration;	— avoiding monitoring that requires lengthy concentration,	
(f) adapting the human-machine interface to the foreseeable characteristics of the operators, including with respect to machinery or a related product with intended fully or partially self-evolving behaviour or logic that is designed to operate with varying levels of autonomy;	— adapting the man/machinery interface to the foreseeable characteristics of the operators.	
(g) where relevant, adapting machinery or a related product with intended fully or partially self-evolving behaviour or logic that is designed to operate with varying levels of autonomy to respond to people adequately and appropriately (such as verbally through words and non-verbally through gestures, facial expressions or body movement) and to communicate its planned actions (such as what it is going to do and why) to operators in a comprehensible manner.		

IFA

Guide to application of MD and MR

- Guide edition 2.3 (13/06/2024)
  - https:// ec.Europa.eu/docsroom/documents/60145
  - Machinery Directive 2006/42/EC
  - Machinery Regulation (EU) 2023/1230


EUROPEAN COMMISSION
Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs

Industrial Transformation and Advanced Value Chains
Advanced Engineering and Manufacturing Systems

Guide to application of the Machinery Directive 2006/42/EC

This 3rd update (Edition 2.3) contains provisions on instructions for use and EC Declaration of Conformity, as well as the assembly instructions for partly completed machinery and Declaration of Incorporation when provided in digital format. They refer to Articles in the new Machinery Regulation (EU) 2023/1230 (OJ L 165, 29.6.2023, ELI: http://data.europa.eu/eli/reg/2023/1230/oj) that entered into force on 19 July 2023 and that will apply as from 20 January 2027.

concepts and requirements of Directive 2006/42/EC in order to ensure uniform interpretation and application throughout the EU. The Guide also provides information about other related EU legislation. It is addressed to all of the parties

1

Organisation of OSH in the EU

- Treaty of Lisbon
- Article 153
  - Minimum requirements on OSH in company
  - OSH Framework Directive 89/391/EEC etc.
  - risk assessment refers to human jobs
  - OSH for worker population
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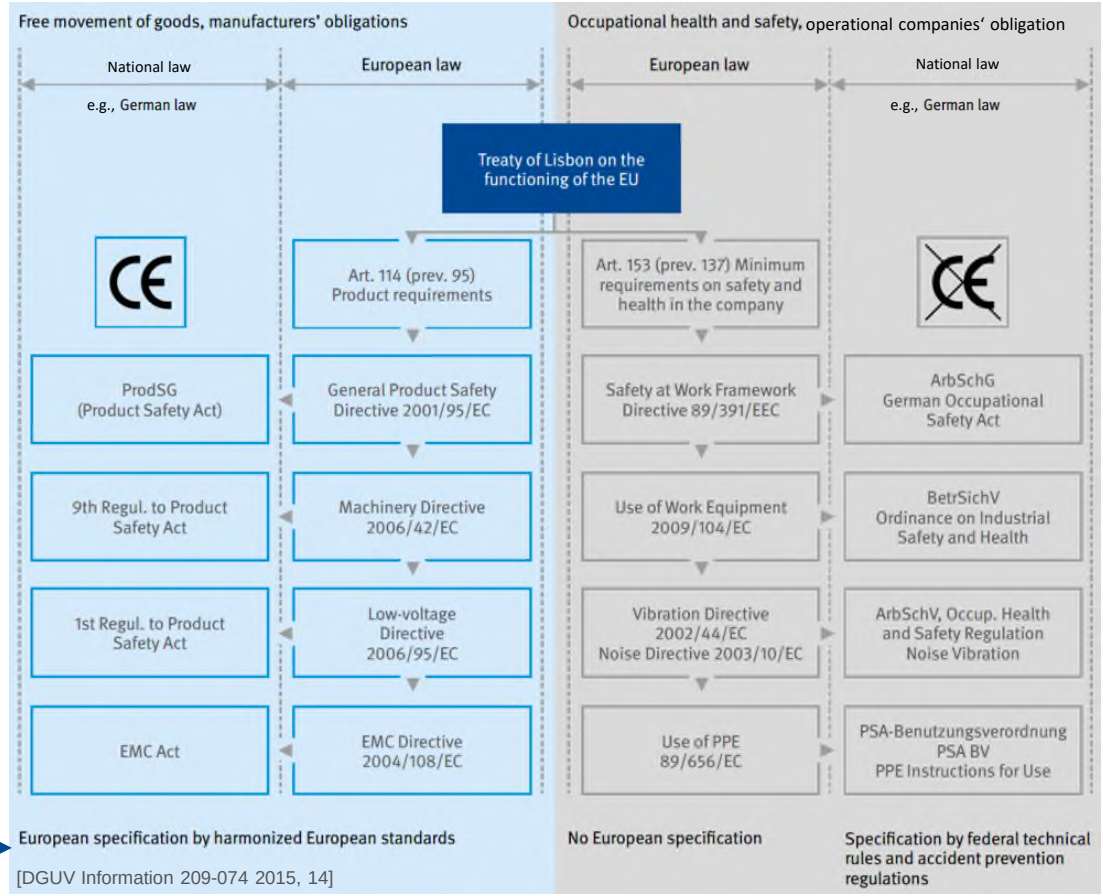

[DGUV Information 209-074 2015, 14]

European Standardisation and Harmonised Standards

- Standards are available at
  - national (e.g., MSZ, ÖNORM, SF, DIN),
  - European (e.g., EN) (= EU national level),
  - international level (e.g., ISO, IEC) and
  - combined levels (MSZ EN, MSZ ISO, MSZ EN ISO)
- ABC types of standards (see EN ISO 12100)
  - A: basic concepts, principles for design and general aspects, applied to machinery
  - B: generic safety aspects, B1 particular safety aspect (e.g., safety distances) or B2 safeguard (e.g., two-hand control)
  - C: machine specific safety

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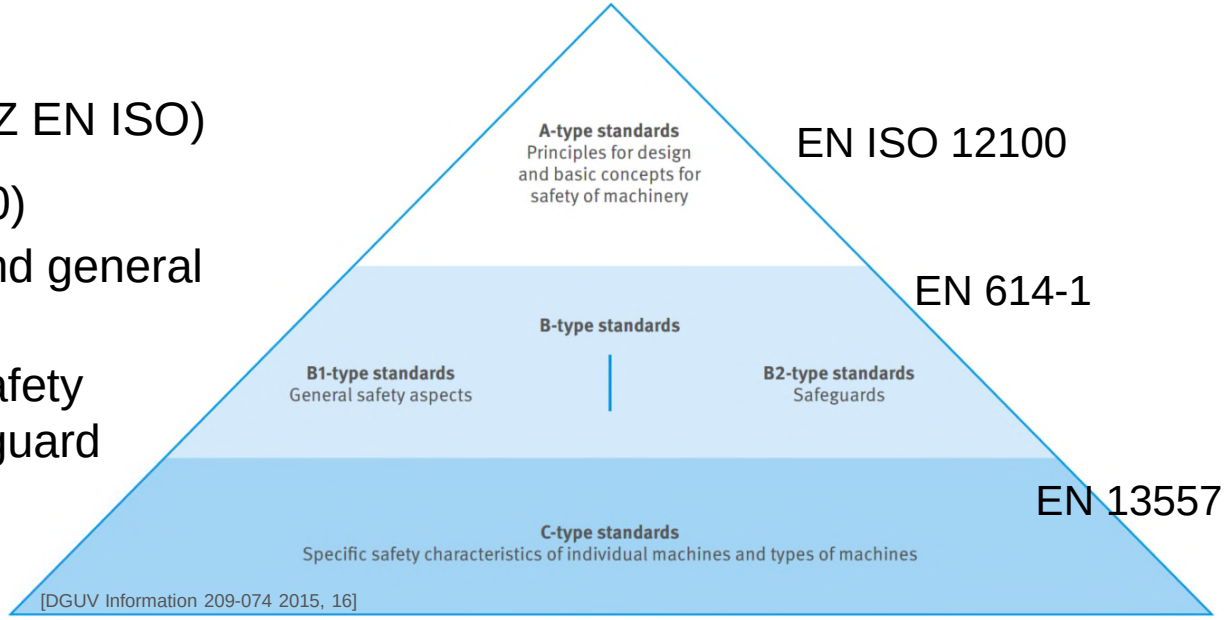
[https://www.cencenelec.eu/about-cen/]



[DGUV Information 209-074 2015, 16]

European Standardisation and Harmonised Standards

- European standard
- European standard harmonised regarding the Machinery Directive 2006/42/EC CE

DEUTSCHE NORM June 2009

DIN EN 614-1

DIN

ICS 13.110; 13.180

Supersedes
DIN EN 614-1:2006-07

Safety of machinery –
Ergonomic design principles –
Part 1: Terminology and general principles
(includes Amendment A1:2009)
English version of DIN EN 614-1:2009-06

- European and international standard
- European standard not harmonised regarding any European Union Directive or Regulation, but nevertheless, of high use in design

ISO

FINAL DRAFT
International Standard

ISO/FDIS 10075-2

Ergonomic principles related to mental workload —

Part 2:
Design principles

Principes ergonomiques relatifs à la charge de travail mentale —
Partie 2: Principes de conception

ISO/TC **159**/SC **1**

Secretariat: **DIN**

Voting begins on:
2024-04-18

Voting terminates on:
2024-06-13

European Standardisation and Harmonised Standards

- Harmonised standards are standards which are developed by the European standardisation organizations on behalf of the European Commission. They specify the basic requirements of EC Directives. Annex ZA/B of a harmonized standard indicates which clauses of the relevant standard fulfil the essential requirements of the EC Directive.
- Harmonised standards according to the Machinery Directive 2006/42/EC:
  - https://eur-lex.europa.eu/eli/dec_impl/2023/1586/oj

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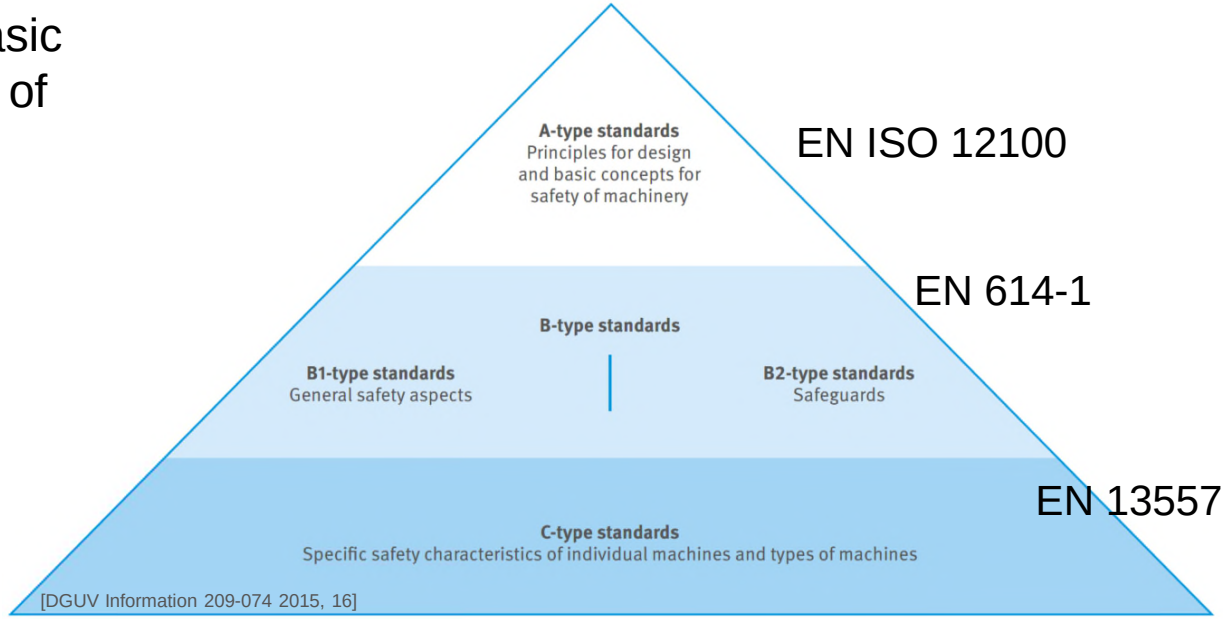
[https://www.cencenelec.eu/about-cen/]

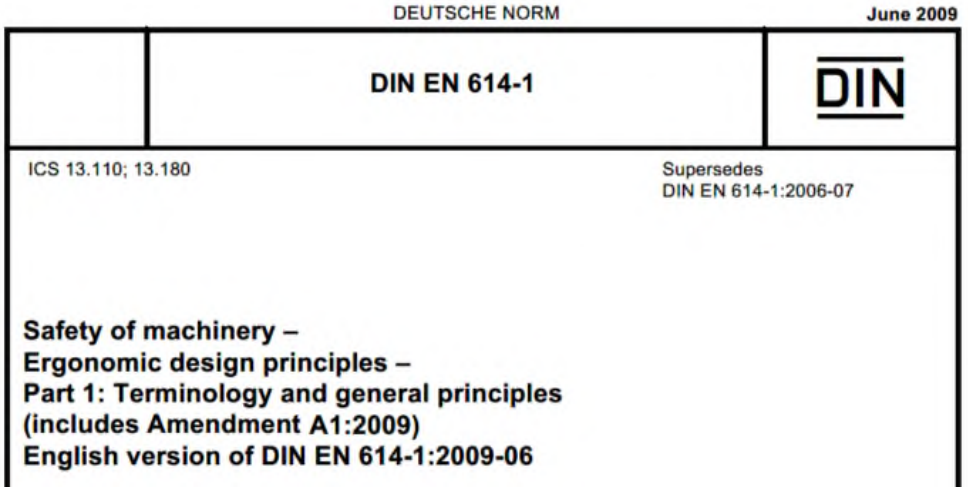


[DGUV Information 209-074 2015, 16]

Harmonised Standards regarding Machinery Safety

- They specify the basic requirements of the Machinery Directive for safety and health protection (see Annex I). When reaching the protection level of an applicable harmonized European standard, the corresponding requirement from the Directive is simultaneously considered satisfied (i.e., the compliance with the corresponding directive).
- Standards are not legally binding. Other measures can replace (harmonised) standards content. But then, the manufacturer must provide verification of compliance with the Directive.

- The so-called presumption of conformity applies with a harmonised standard available. By satisfying the protective objectives of this standard, it is assumed that conformity with the directive is ensured for this safety aspect.



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HFE Harmonised Standards according to the Machinery Directive/Regulation

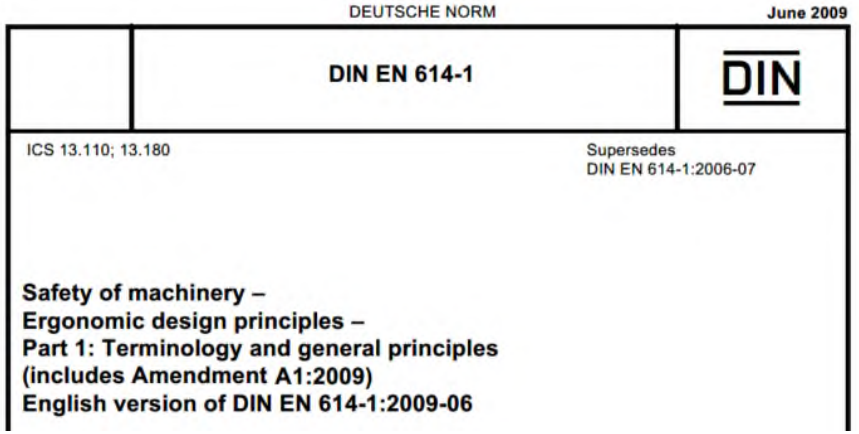
- Several harmonised standards
  https://eur-lex.europa.eu/eli/dec_impl/2023/1586/oj
  - most related to pure safety issues
    (CEN/ TC 199 Machinery safety)
    e.g., EN ISO 12100, EN ISO 13849
  - some related to ergonomics in safety issues
    (CEN/ TC 122 Ergonomics)
    e.g., EN 614 series, EN 894 series
- EN 614 Safety of machinery
  - Ergonomic design principles
  - Part 1: Terminology and general principles
  - Part 2: Interactions between the design of machinery and work tasks
- EN 894 Safety of machinery
  - Ergonomics requirements for the design of displays and control actuators
  - Part 1: General principles for human interactions with displays and control actuators, Part 2: …
- EN 981: Safety of machinery
  - System of auditory and visual danger and information signals
- EN ISO 7731: Ergonomics
  - Danger signals for public and work areas
  - Auditory danger signals
- etc.

Revision of Harmonised Standards

- Revisions performed as usual
- Current challenge due to lack of transition period towards MR (EU) 2023/1230
- MR (EU) 2023/1230 effective by 01/01/2027
- Most of standards harmonized regarding the MD 206/42/EC will (partly) be valid regarding the MR (EU) 2023/1230
- But, issues new to MR (EU) 2023/1230 need to be taken care of by manufacturers until standard revision covers all new issues
- EC will update list of harmonized standards

Specification of Essential Health & Safety Requirements

- CEN/ TC 122/ WG 2 started revision of EN 614
  - Part 1: Terminology and general principles
  - Part 2: Interactions between the design of machinery and work tasks
- Next are others, e.g. EN 894 series, EN 981



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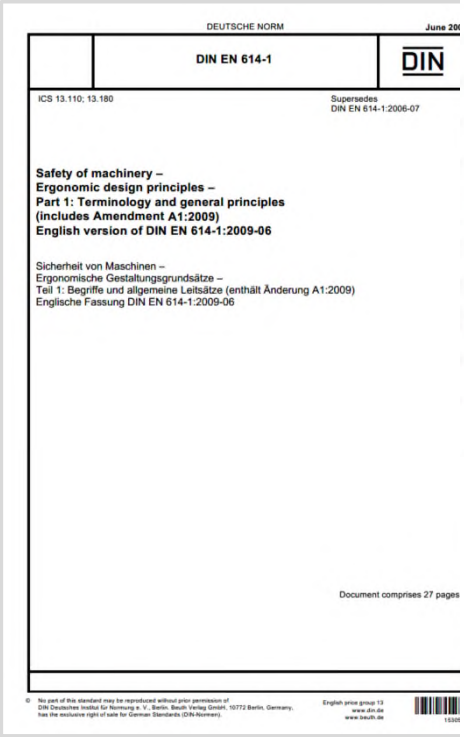
EN 614 series: Sa

- Part 1: Terminology a



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Sicherheit von Maschinen –
Ergonomische Gestaltungsgrundsätze –
Teil 1: Begriffe und allgemeine Leitsätze (enthält Änderung A1:2009)
Englische Fassung DIN EN 614-1:2009-06

Document comprises 27 pages

English price group 13
www.din.de
www.beuth.de

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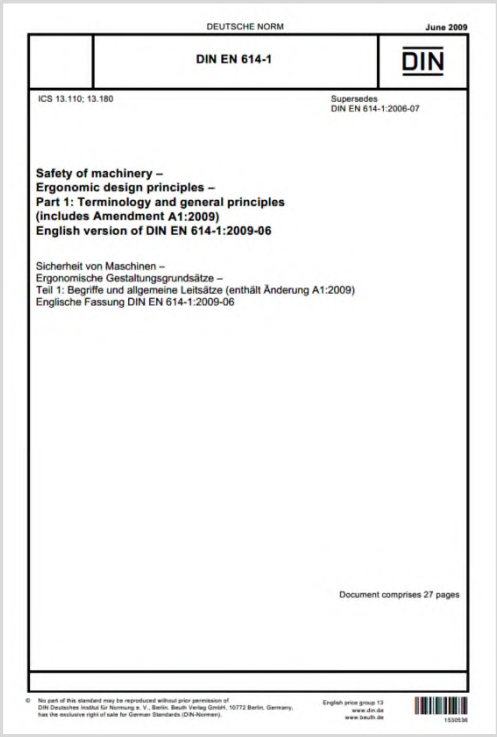
4.1 General 9
4.2 Accessible design for people with special requirements 9
4.3 Taking account of people's body dimensions, postures, body movements, and physical strength 10
4.4 Taking account of people's mental abilities 13
4.5 Taking account of the influence of the physical work environment on people 14
5 Incorporating ergonomic principles into the design process of machinery 15
5.1 General 15
5.2 Ergonomics tasks to be performed during the design process of machinery 16

EN 614 series: Safety of Machir

- Part 1: Terminology and general princip



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www.din.de
www.beuth.de

Annex ZB
(informative)

A1 Relationship between this European Standard and the Essential Requirements of EU Directive 2006/42/EC

This European Standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association to provide a means of conforming to Essential Requirements of the New Approach Directive 2006/42/EC on machinery.

Once this standard is cited in the Official Journal of the European Communities under that Directive and has been implemented as a national standard in at least one Member State, compliance with the normative clauses of this standard given in Table ZB.1 confers, within the limits of the scope of this standard, a presumption of conformity with the relevant Essential Requirements of that Directive and associated EFTA regulations.

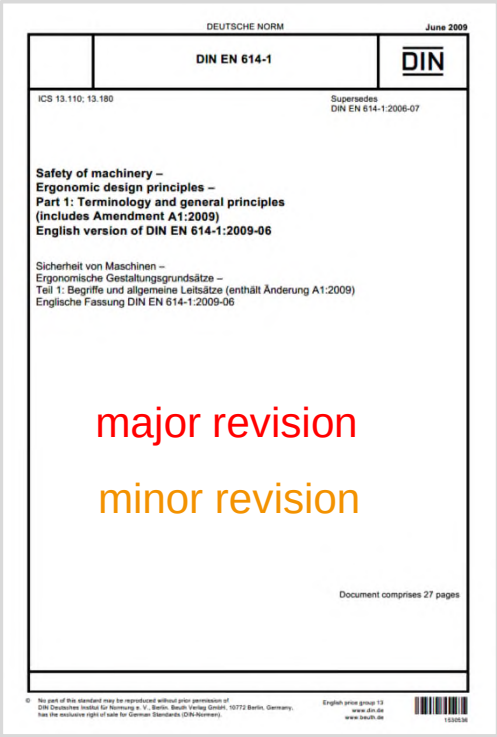
Table ZB.A.1 — Correspondence between this European Standard and Directive 2006/42/EC

Clause(s)/sub-clause(s) of this EN	Essential Requirements (ERs) of Directive 2006/42/EC	Qualifying remarks/Notes
All clauses	Annex I: 1.1.2, 1.1.6, 1.1.7, 1.1.8, 1.2.2, 1.5.5, 1.5.8, 1.5.9, 1.7.1, 1.7.1.2, 1.7.2	-

WARNING — Other requirements and other EU Directives may be applicable to the product(s) falling within the scope of this standard. A1

EN 614 series: Safety of Machinery – Ergonomics design principles

- Part 1: Terminology and gen



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Englische Fassung DIN EN 614-1:2009-06

major revision

minor revision

Document comprises 27 pages

Annex	EHSR
1.1.2	Principles of safety integration
1.1.6	Ergonomics
1.1.7	Operating positions
1.1.8	Seating
1.2.2	Control devices
1.5.5	Extreme temperatures
1.5.8	Noise
1.5.9	Vibrations
1.7.1	Information and warnings on the machinery or related product
1.7.1.2	Warning devices
1.7.2	Warning of residual risks

Include changes in EHSR (ch. 1) if not already covered in other standards

- 1.2.1. Safety and realiability of control systems
  - Control system of machinery or related products (with AI) shall be designed and constructed in such a way that: … (c) it shall be possible at all times to correct the machinery or related product in order to maintain its inherent safety.
- 1.3.7. Risks related to moving parts
  - The prevention of risks of contact leading to hazard situations and the psychological stress that may be caused by the interaction with the machine shall be adapted to: (a) human-machine coexistence in a shared space without direct collaboration; (b) human-machine interaction.
- 1.6.2. Access to operating positions and servicing points
  - In the case of machinery or related products into which persons shall enter for operation, adjustment, maintenance or cleaning, the machinery accesses shall be dimensioned and adapted for the use of rescue equipment in such a way that an emergency rescue of the persons is possible.
- 1.7.1. Information and warnings on the machinery or related product
  - Any written or verbal information and warnings must be expressed in a language which can be easily understood by users, as determined by the Member State concerned.

EHSR 1.1.6. Ergonomics

- Under the intended conditions of use, the discomfort, fatigue and physical and psychological stress faced by the operator shall be eliminated or reduced to the minimum possible, taking into account at least, the following ergonomic principles:

Annex III Regulation	Annex I Directive
(a) allowing for the variability of the operator's physical dimensions, strength and stamina;	— allowing for the variability of the operator's physical dimensions, strength and stamina,
(b) avoiding the need for demanding work postures or movements and manual force exertions that exceed the operator's capacity;	
(c) providing enough space for movements of the parts of the operator's body;	— providing enough space for movements of the parts of the operator's body,
(d) avoiding a machine-determined work rate;	— avoiding a machine-determined work rate,
(e) avoiding monitoring that requires lengthy concentration;	— avoiding monitoring that requires lengthy concentration,
(f) adapting the human-machine interface to the foreseeable characteristics of the operators, including with respect to machinery or a related product with intended fully or partially self-evolving behaviour or logic that is designed to operate with varying levels of autonomy;	— adapting the man/machinery interface to the foreseeable characteristics of the operators.
(g) where relevant, adapting machinery or a related product with intended fully or partially self-evolving behaviour or logic that is designed to operate with varying levels of autonomy to respond to people adequately and appropriately (such as verbally through words and non-verbally through gestures, facial expressions or body movement) and to communicate its planned actions (such as what it is going to do and why) to operators in a comprehensible manner.	

EHSR 1.1.6. Ergonomics

- Under the intended conditions of use, the discomfort, fatigue and physical and psychological stress faced by the operator shall be eliminated or reduced to the minimum possible, taking into account at least, the following ergonomic principles:

At least all ergonomic principles mentioned

e.g., guidance on how to assess operator‘s capacity

Human-machine interface design for dynamic function allocation (i.e., adaptive and adaptable human-automation interaction)

Feedback design for dynamic funtion allocation

Annex III Regulation	Annex I Directive
(a) allowing for the variability of the operator's physical dimensions, strength and stamina;	— allowing for the variability of the operator's physical dimensions, strength and stamina,
(b) avoiding the need for demanding work postures or movements and manual force exertions that exceed the operator's capacity;	
(c) providing enough space for movements of the parts of the operator's body;	— providing enough space for movements of the parts of the operator's body,
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EHSR 1.1.6. Ergonomics

- Under the intended conditions of use, the discomfort, fatigue and physical and psychological stress faced by the operator shall be eliminated or reduced to the minimum possible, taking into account at least, the following ergonomic principles:
  - …
  - (f) adapting the human-machine interface to the foreseeable characteristics of the operators,

; …

4.4 Taking account of people's mental abilities

4.4.1 General

The machine and its associated elements (displays, signals, control actuators, instructions etc.) shall be designed to suit not only the physical but also the mental abilities of the expected population of operators. The term mental in this sense refers to cognitive, informational and emotional processes of the human being, as specified in EN ISO 10075–1. Mental ability is associated with the operator's ability to control the machinery and perform the required tasks.

NOTE Poor compatibility between the operator's mental abilities and the requirements for use results in unsafe operation and leads to impairing effects on the operator's health and well-being. Poor compatibility is also an obstacle to learning and training.

4.4.2 Requirements for interaction between operator and machinery

Requirements and guidelines for ensuring controlled and safe operation of the machinery are given in EN ISO 7731, EN 842, EN 894-1, EN 894-2 and EN 981. Guidelines to help the designer avoid impairing effects on the operator (over- or underload, fatigue, monotony, reduced vigilance, satiation; see EN ISO 10075–1) are described in EN ISO 9241-110 and EN ISO 10075-2 in detail. Principles for designing suitable operator's work tasks are described in EN 614-2:2000, 4.1. The following ergonomic principles shall be taken into account:

a) machinery shall support the operator when performing recurrent tasks. The operator should be supported in such a way that the operation does not overload nor underload the mental abilities (principle of suitability for the task);

b) underlying process and the functioning of the machinery shall be easily understandable for the operator (principle of self-descriptiveness);

c) operator shall have control over the machine and its components (principle of controllability);

d) machinery shall be, as far as possible, compatible with the operator's expectations based on previous work experience and training (principle of conformity with user expectations);

e) machinery shall be error tolerant and provide the operator with the means for handling errors (error should not lead to a hazardous situation; principle of error tolerance);

f) machinery shall allow the operators an appropriate degree of autonomy with regard to decisions on priorities and procedures (principle of suitability for individualisation);

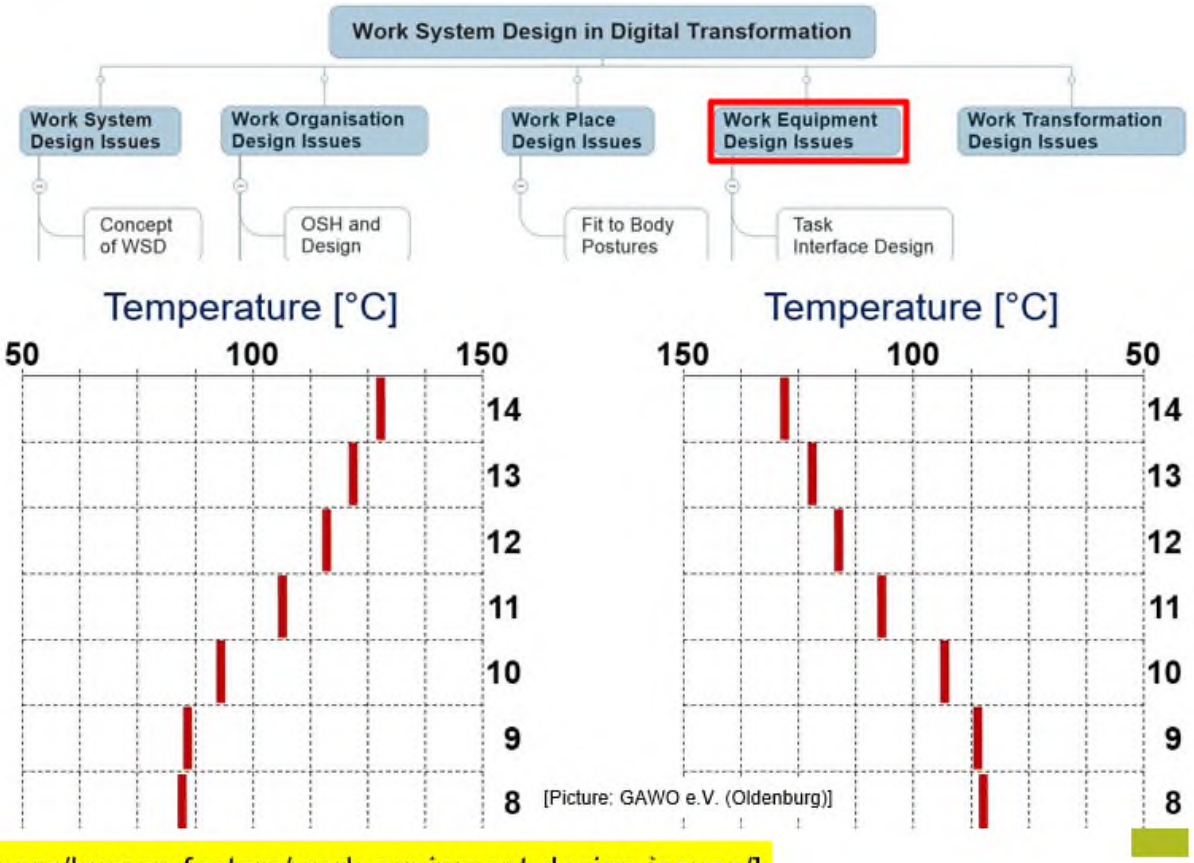
g) machinery shall allow the development of existing abilities and the attainment of new skills (principle of suitability for learning);

h) machinery shall be flexible enough to be adapted to the variation of the skills within the operator population (see EN 614-2) and, if necessary to special needs (see 4.2).

4.4.3 Signals and controls

Work Equipment Design – Interaction Interface Design

- **Principles of interaction design**
  - Conformity to user expectations (EN 614-1) of function, movement and position of displays and controls.
  - Example:
    - population stereotypes
    - scales for temperature increase and decrease (see left and right picture)
    - reasonably foreseeable human error during operation may lead to hazardous situations.



[www.safe-machines-at-work.org/human-factors/work-equipment-design-issues/]

EHSR 1.1.6. Ergonomics

- Under the intended conditions of use, the discomfort, fatigue and physical and psychological stress faced by the operator shall be eliminated or reduced to the minimum possible, taking into account at least, the following ergonomic principles:
  - …
  - (f) adapting the human-machine interface to the foreseeable characteristics of the operators, including with respect to machinery or a related product

    that is designed to operate with varying levels of autonomy; …

4.4 Taking account of people's mental abilities

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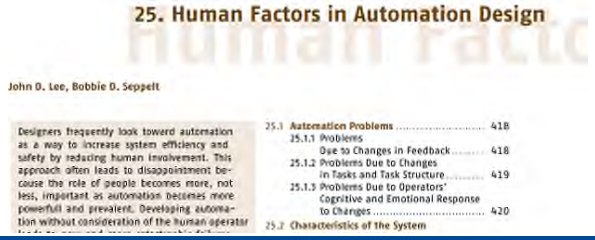
g) machinery shall allow the development of existing abilities and the attainment of new skills (principle of suitability for learning);

h) machinery shall be flexible enough to be adapted to the variation of the skills within the operator population (see EN 614-2) and, if necessary to special needs (see 4.2).

4.4.3 Signals and controls

Human Factors in Automation Design

- Design challenges – design for
  - changes in operator feedback
  - changes in operator tasks and task structure
  - operators' mental response to change
- Combat ironies of automation
- Design joint human-automation systems
- Automation is not a homogenous technology!
  - Human-automation design is system design
  - function allocation, what is automated, level of automation, human-system interactions, simulation etc.



25. Human Factors in Automation Design

John D. Lee, Bobbie D. Seppelt

Designers frequently look toward automation as a way to increase system efficiency and safety by reducing human involvement. This approach often leads to disappointment because the role of people becomes more, not less, important as automation becomes more powerfull and prevalent. Developing automation without consideration of the human operator

25.1 Automation Problems 418
25.1.1 Problems Due to Changes in Feedback 418
25.1.2 Problems Due to Changes in Tasks and Task Structure 419
25.1.3 Problems Due to Operators' Cognitive and Emotional Response to Changes 420
25.2 Characteristics of the System

[By Matti Blume, Detail of a portainer at Containerterminal Burchardkai, Hamburg, 2019, CC BY-SA 4.0, via WikiMediaCommons]

EHSR 1.1.6. Ergonomics

- Under the intended conditions of use, the discomfort, fatigue and physical and psychological stress faced by the operator shall be eliminated or reduced to the minimum possible, taking into account at least, the following ergonomic principles:
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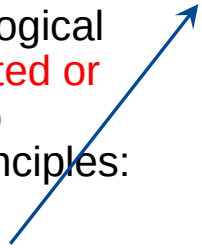
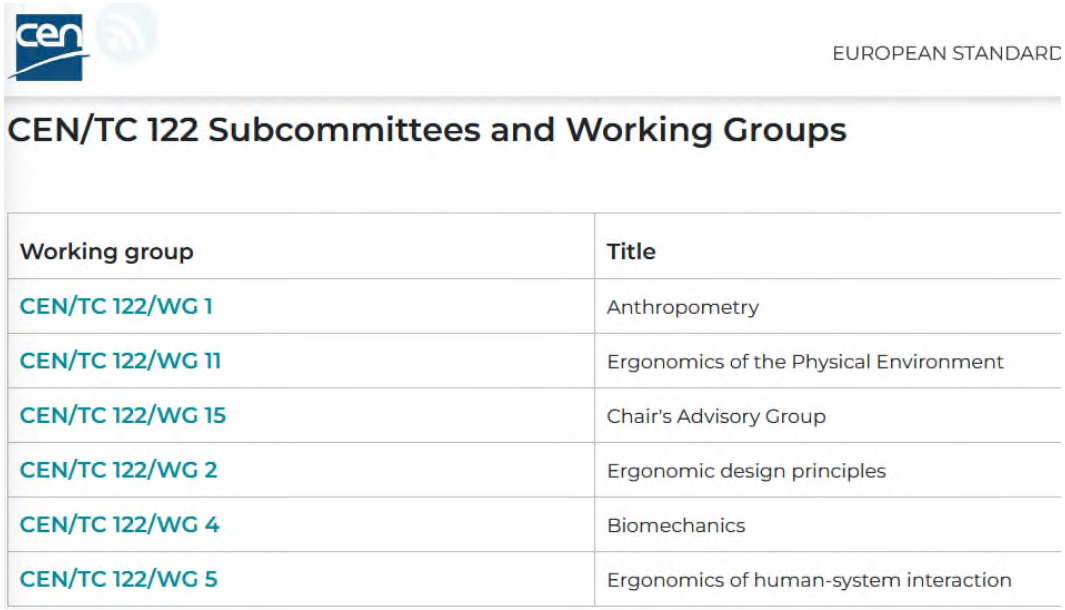


- Human Factors and AI
  - „… intended fully or partially self-evolving behaviour or logic …“
  - Has self-learning been finished or not before placing machine into operation?
  - What is required from HFE perspective, when machine functioning is dynamic and not necessarily predictable in the long run?
  - …

CEN TC 122/ WG 2 has started the revision of EN 614-1

- In-person-Meeting of CEN TC 122/ WG 2 for hands-on revision of EN 614-1
  - Sept 2024
  - Mainz (Germany)
  - hosted by: German Social Accident Insurance Institution of the metal and woodworking industry (BGHM)
- Participants
  - Employers, Trade Unions,
  - Health & Safety professionals,
  - Research, …
- Contact your national standardisation body!



EUROPEAN STANDARD

CEN/TC 122 Subcommittees and Working Groups

Working group	Title
CEN/TC 122/WG 1	Anthropometry
CEN/TC 122/WG 11	Ergonomics of the Physical Environment
CEN/TC 122/WG 15	Chair's Advisory Group
CEN/TC 122/WG 2	Ergonomic design principles
CEN/TC 122/WG 4	Biomechanics
CEN/TC 122/WG 5	Ergonomics of human-system interaction

Thank you very much for your attention!

Contact:

Dr. Peter Nickel

Institute for Occupational Safety and Health of the German Social Accident Insurance (IFA)

D: Accident Prevention: Digitalisation – Technologies
S: Intelligent Technical Systems & Work Environment
U: Human-System Interaction

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[By Peter Nickel; Verkehrshaus, CH]