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Part 2: Safety requirements for hand-held laser processing devices

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Introduction

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For international standards, comments will be reviewed by the relevant UK national committee before sending the consensus UK vote and comments to the international committee, which will then decide appropriate action. If the international standard is approved, it is usual for the text to be published as a British Standard.

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Date: xx/xx/20xx	Document: ISO/DIS xxxx
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1	2	(3)	4	5	(6)	7
MB	Clause No./ Subclause No./Annex (e.g. 3.1)	Paragraph/Figure/ Table/Note	Type of comment	Commend (justification for change) by the MB	Proposed change by the MB	Secretariat observations on each comment submitted
	3.1	Definition 1	ed	Definition is ambiguous and needs clarifying.	Amend to read '...so that the mains connector to which no connection...'	
	6.4	Paragraph 2	te	The use of the UV photometer as an alternative cannot be supported as serious problems have been encountered in its use in the UK.	Delete reference to UV photometer.	



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SECRETARIAT:

United States of America

SECRETARY:

Mr William Ertle

OF INTEREST TO THE FOLLOWING COMMITTEES:

PROPOSED HORIZONTAL STANDARD:



Other TC/SCs are requested to indicate their interest, if any, in this CD to the secretary.

FUNCTIONS CONCERNED:

☐ EMC

☐ ENVIRONMENT

☐ QUALITY ASSURANCE

☒ SAFETY

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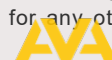
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TITLE:

Safety of machinery — Laser processing machines — Part 2: Safety requirements for hand-held or hand-operated laser processing machines

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CD stage

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A model manuscript of a draft International Standard (known as "The Rice Model") is available at https://www.iso.org/iso/model_document-rice_model.pdf

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Contents

Foreword.....	vi
Introduction.....	vii
1 Scope.....	1
2 Normative references.....	2
3 Terms and definitions	3
4 Hazards.....	5
4.1 General.....	5
4.2 Sources of laser radiation emission as origins of laser radiation hazards	6
4.2.1 General	6
4.2.2 Possible emission sources of direct laser beam(s)	6
4.2.3 Possible emission sources of unintended direct laser beam due to specular reflection and divergent radiation due to scattered reflection	6
4.2.4 Inadequate design or malfunction of laser component(s) of HLM or laser radiation protection measures	7
4.2.5 Inadequate design of safety functions and safety-related parts of control systems (SPR/CS).....	7
4.3 Characteristics of laser radiation.....	7
4.4 Hazards related to the use of HLM.....	8
4.4.1 Unauthorized operation.....	8
4.4.2 Improper movement	8
4.4.3 Unshielded application of HLM in free work space and surroundings.....	8
4.5 Hazards by disregarding ergonomic principles	8
5 Safety requirements and measures.....	9
5.1 General requirements.....	9
5.2 Risk assessment	9
5.2.1 General	9
5.2.2 Hazard identification	9
5.2.3 Documentation of risk assessment results	9
5.3 Protection against laser radiation hazards	9
5.3.1 General	9
5.3.2 Laser Classification	10
5.3.3 Protection during operation and maintenance	11
5.3.4 Protection during service	11
5.4 Design requirements	11
5.4.1 Design according to ergonomic principles.....	11
5.4.2 Protective enclosure.....	12
5.4.3 Authorizing control device.....	12
5.4.4 Emission warning device	12
5.4.5 Alignment laser	12
5.4.6 Safety devices for scanning laser radiation	12
5.4.7 Emergency stop control.....	13
5.4.8 Controls and circuits	13
5.4.9 Provisions for isolation of the laser beam.....	16
5.4.10 Protection against hazards generated by materials and substances	17
6 Verification of safety requirements and measures	17
6.1 General.....	17
6.2 Control category classification.....	19
6.3 Laser classification.....	19

6.4 Matters to be attended for verification and validation	19
7 Information for user.....	19
7.1 Mandatory information.....	19
7.2 Optional information	20
7.3 Instructions	21
8 Labelling	21
8.1 Information to be indicated in labels.....	21
8.2 Labels styles	22
Annex A (informative) Representative types of hand-held or hand-operated laser processing machines (HLMs).....	23
A.1 Machines equipped with a hand-held or hand-operated laser processing head handling system where the laser processing head is connected to a remotely located (i.e. external) laser device a via beam delivery system (e.g. fibre optic cable).....	23
A.2 Machine equipped with a hand-held or hand-operated laser assembly which is manually positioned relative to the fixed workpiece	24
A.3 Machine equipped with a fixed laser assembly, where the workpiece is manually guided or manually positioned relative to the laser processing head (beam shaping device)	24
Annex B (informative) Possible further hazards related to hand-held or hand operated laser processing machines (HLMs)	25
B.1 Inherent hazards	25
B.2 Hazards induced by external effects (interferences)	26
B.3 Confined space.....	26
B.4 Working at heights.....	26
B.5 Environmental effects.....	26
Annex C (informative) Examples for the design of technical safety measures for Hand-held or Hand-operated Laser Processing Machines (HLMs)	28
C.1 General	28
C.2 Examples for engineering measures (inherently safe design) and technical measures for HLMs	28
C.3 Enabling control devices for HLM.....	29
C.4 Sensors for HLM using proximity detectors and/or switches contact monitor.....	29
C.4.1 Contact needles/pins	29
C.4.2 Mechanical switch for contact detection	30
C.4.3 Non-contact inductive or capacitive sensors for activating control measures.....	30
C.4.4 Ultrasonic sensors	30
C.4.5 Inclometers and acceleration sensors.....	30
Annex D (informative) Recommendations for the Selection of Personal protective Equipment for Use with Hand-held or Hand-operated Laser Processing Machines (HLMs).....	32
D.1 General	32
D.2 Evaluation and selection.....	32

D.3 Examples of personal protective equipment..... 33

Bibliography 34

Annex ZA (informative) Relationship between this European Standard and the Essential
Requirements of Directive 2006/42/EC Aimed to be Covered..... 36

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 172, *Optics and photonics*, Subcommittee SC 9, *Laser and electro-optical systems* in collaboration with IEC/TC 76, *Optical radiation safety and laser equipment*.

This second edition cancels and replaces the first edition (ISO 11553-2:2007), which has been technically revised with the following main changes:

- Several terms and definitions were modified or newly added;
- Table 1 was newly added in Clause 6, and the previous old Annex A was deleted;
- Several subclause headings were modified and several technical requirements were amended;
- Some of the lists were renumbered;
- Previous Annex B was modified and was renumbered as the new Annex A;
- New Annex B, Annex C and Annex D were added.

A list of all parts in the ISO 11553 series can be found on the ISO website/IEC website.

Any feedback or questions on this document should be directed to the user's national standards body.

A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

This document is a type-C standard as stated in ISO 12100:2010.

This document is of relevance, in particular, for the following stakeholder groups representing the market players with regard to machinery safety:

- hand-held or hand-operated laser processing machines (HLMs) manufacturers (small, medium and large enterprises); including manufacturers of sub/part machines such as devices or devices assembly related to laser radiation, as well as system integrators (small, medium, and large enterprises);

NOTE Devices or devices assembly are including but not limited to: guiding devices; shaping devices, delivery devices, protective devices, locking devices; control devices, enabling devices, limiting devices, impeding devices; switching devices, exhaust devices, stop devices; loading/feeding devices; scanning devices; warning devices.

- health and safety bodies (regulators, accident prevention organizations, market surveillance, etc.).

Others can be affected by the level of machinery safety achieved with the means of the document by the above-mentioned stakeholder groups:

- machine users/employers (small, medium and large enterprises);
- machine users/employees (e.g., trade unions, organizations for people with special needs);
- service providers, e.g., for maintenance (small, medium and large enterprise);
- consumers (in case of machinery intended for use by consumers).

The above-mentioned stakeholder groups have been given the possibility to participate at the drafting process of this document.

The machinery concerned and the extent to which hazards, hazardous situations or hazardous events are covered are indicated in the Scope of this document.

When requirements of this type-C standard are different from those which are stated in type-A or type-B standards, the requirements of this type-C standard take precedence over the requirements of the other standards for machines that have been designed and built according to the requirements of this type-C standard.

The purpose of this document is to prevent injuries to persons:

- by listing potential hazards generated by hand-held or hand-operated laser processing machines;
- by describing the risk assessment procedure for all relevant hazard;
- by specifying safety measures and verification procedures necessary for reducing the risk caused by specific hazardous conditions;
- by providing references to pertinent standards;
- by specifying the information which is to be supplied to the user so that they can establish proper procedures and precautions at the workplace.

Safety of machinery — Laser processing machines — Part 2: Safety requirements for hand-held or hand-operated laser processing machines

1 Scope

This document specifies the requirements for hand-held or hand-operated laser processing machine (HLM) and their components as well as assemblies. HLM is the machine in which laser radiation is generated, laser provides sufficient energy/power to cause a phase transition in a part of the workpiece and where the laser output or workpiece to be processed is guided manually or hand-held during the laser process.

HLM includes laser device, beam-guiding device (e.g., mirror, fibre, lenses), beam-shaping device (e.g., telescope, focusing), controls. laser assembly as an integral part of HLM or only the laser processing head is hand-held or hand-operated during the laser process.

NOTE “device” mentioned in this document without laser radiation emitted (e.g., relevant devices, cooling devices, delivery devices, guiding devices, etc.).

This document does not apply to laser processing machines which remotely controlled by manual controller (hand-operated controller), using such as joy sticks, keyboard, etc., without touching a workpiece or a part mechanically connected with the laser processing head by using the hand(s) of operator (user).

Those laser processing machines without drive system which may not belong to machinery. And the laser processing apparatus without moving parts, which may not be considered as machinery in “Type C standard”.

NOTE “hand-operated laser processing machine” is synonymous with “hand-guide laser processing machine” in this document. Hand-operated laser processing machines often use manual force reduction means such as wheels, supports, etc., for manual positioning of the laser processing heads or the workpieces.

It is applicable to HLMs using laser radiation to process materials.

The purpose of this document is to draw attention to the hazards related to HLMs and to prevent personal injury. Depending on the application and the location/operating conditions of HLMs a number of different significant hazards can arise. This document describes both the areas of hazards analysis and risk assessment as well as protective measures.

Requirements dealing with noise as hazard are covered by ISO 11553-3.

This document deals with the specific hazards resulting from laser radiation arising in HLMs, when they are used as intended and under condition of misuse which are reasonably foreseeable by the manufacturer.

This document does not apply to laser products or equipment manufactured solely or expressly for applications which are excluded from the scope of ISO 11553-1:2020. This document is not applicable for HLMs which have been manufactured before the date of publication of this standard.

HLMs include the following types:

- HLMs which are designed as all in-one laser assembly including the beam delivery/forming(shaping) system and optional features such as gas nozzles, material (e.g., powder, wire) feed system;
- HLMs where the relevant devices are connected by a beam guidance system (e.g., optical fiber) and power/control cables to an external laser assembly and which includes only the beam delivery/forming(shaping) system and optional features such as gas nozzles, material (e.g., powder, wire) feed system;

- laser processing machines where the workpiece is manually moved under/relative to the laser beam (see informative Annex A).

The intended use of HLMs covers both:

- movement of the laser processing head (beam shaping device) by hand to move laser beam(s) over or relative to elements or workpieces to be processed, and
- movement of elements or workpieces by hand to be processed under/relatively to stationary laser beams as shielded.

NOTE Laser processing machines, where laser processing is performed with hand-held or hand-operated workpieces outside the fixed (neither hand-held nor operated-operated by the operator or user) laser processing machines are out of the scope of this document. Such a fixed laser processing machine is to be covered by ISO 11553-1.

HLMs are intended for the industrial use and can be only operated by trained and authorized personnel in indoor and/or outdoor environments/locations (e.g., cleaning of facades, statues).

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 3864 (all parts), *Graphical symbols — Safety colours and safety signs — Part 1: Design principles for safety signs and safety markings*

ISO 11145:2018, *Optics and photonics — Lasers and laser-related equipment — Vocabulary and symbols*

ISO 11252:2013, *Lasers and laser-related equipment — Laser device — Minimum requirements for documentation*

ISO 11553-1:2020, *Safety of machinery — Laser processing machines — Part 1: General safety requirements*

ISO 12100:2010, *Safety of machinery — General principles for design — Risk assessment and risk reduction*

ISO 13849-1:2015, *Safety of machinery — Safety-related parts of control systems — Part 1: General principles for design*

ISO 13849-2:2012, *Safety of machinery — Safety-related parts of control systems — Part 2: Validation*

ISO 13850:2015, *Safety of machinery — Emergency stop function — Principles for design*

ISO 13851:2019, *Safety of machinery — Two-hand control devices — Functional aspects and design principles*

ISO 14118:2017, *Safety of machinery — Prevention of unexpected start-up*

ISO 14119:2013, *Safety of machinery — Interlocking devices associated with guards — Principles for design and Selection*

IEC 60204-1:2016, *Safety of machinery — Electrical equipment of machines — Part 1: General requirements*

IEC 60825-1:2014, *Safety of laser products — Part 1: Equipment classification and requirements*

IEC 60825-4:2011, *Safety of laser products — Part 4: Laser guards*

IEC 62061:2021, *Safety of machinery — Functional safety of safety-related control systems*

ISO 6385:2016, *Ergonomics principles in the design of work system*

ISO 26800:2011, *Ergonomics — General approach, principles and concept*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 11145, ISO 11553-1, ISO 12100, IEC 60825-1, IEC 60825-4 and the following apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <https://www.electropedia.org/>

3.1

confined space

working area surrounded on all sides, or for the most part, by solid walls where they, on account of their confinement or containment of materials, preparation or equipment, augment or can augment particular hazards that considerably exceed the hazard potential normally prevailing at workplaces

3.2

disposal unit

equipment that captures and removes effluents and/or chemical pollutants (e.g., fumes, gases) by-products during laser material processing passing these on for filtration

EXAMPLE Capture devices, pipes, filtration systems, ventilation systems.

3.2

hazard area

danger zone

any space within and/or around machinery in which a person can be exposed to a hazard

Note 1 to entry: There maybe several hazard areas (danger zones) on the same workplace depending on the types of hazards and relevant safety control measures against the hazards.

Note 2 to entry: For “laser hazard area”, see 3.4.

Note 3 to entry: Hazard area (Danger zone) is not synonymous to “laser hazard area” and “nominal ocular hazard area (NOHA)”.

[SOURCE: ISO 12100:2010, 3.11, modified, Note 1 to entry, Note 2 to entry and Note 3 to entry added]

3.3

hand-held laser processing machine

HLM

machine in which laser radiation is generated, together with essential additional facilities (e.g., cooling, power and gas supply) that are necessary to operate the laser. Laser provides sufficient energy/power to melt, evaporate or cause a phase transition in a part of the workpiece and where the laser output or workpiece to be processed is guided manually or hand-held during the laser process

3.4

laser hazard area

area in which the laser radiation exposure of the eye and/or the skin exceeds the respective maximum permissible exposure values (MPEs), including the possibility of accidental misdirection of the laser beam

Note 1 to entry: To avoid ambiguities, information whether the laser hazard area is based on the eye or the skin MPEs should be added.

Note 2 to entry: See 3.9 for nominal ocular hazard area.

[SOURCE: IEC 60825-1:2014, 3.47, modified, Note 2 to entry added]

3.5

laser system

laser in combination with an appropriate laser energy source with or without additional incorporated components

[SOURCE: IEC 60825-1:2014, 3.51]

See Figure 1.

3.6

laser assembly

laser system together with specific, normally optical, mechanical and/or electrical system components for beam handling and forming

[SOURCE: ISO 11145:2001, 3.27, modified, “laser device” replaced by “lase system”]

See Figure 1.

3.7

laser device

laser where the radiation is generated, together with essential additional facilities (e.g., cooling, power and gas supply) that are necessary to operate the laser

[SOURCE: ISO 11145:2001, 3.29]

See Figure 1.

3.8

laser unit

one or more laser assemblies together with handling, measurement and control systems

[SOURCE: ISO 11145:2001, 3.32]

See Figure 1.

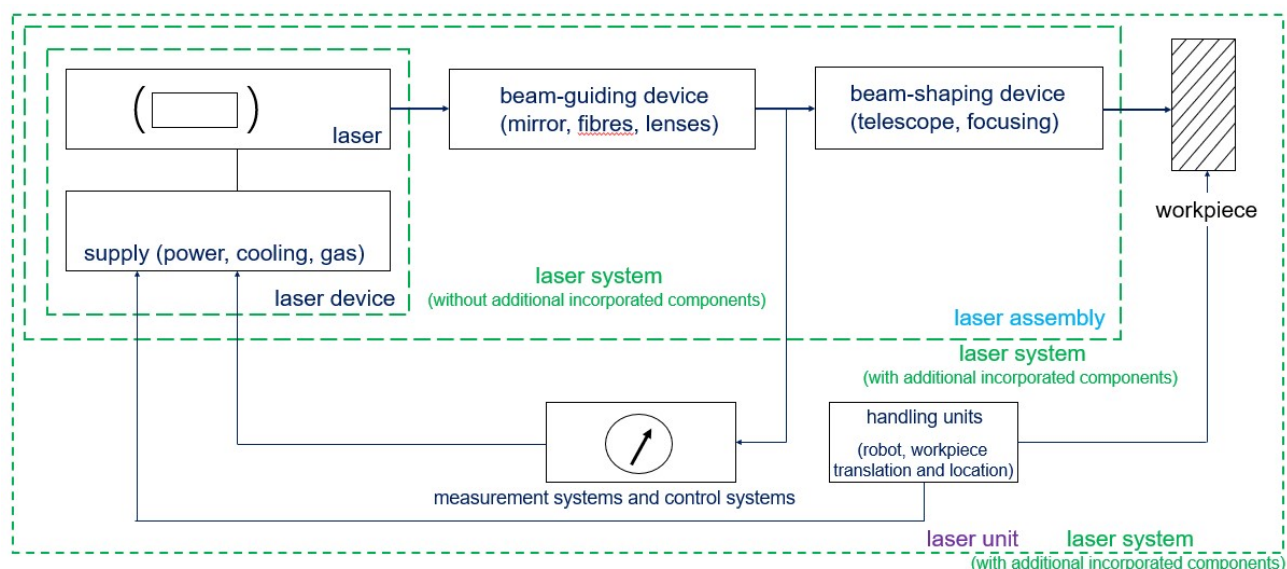


Figure 1 — Illustration of the terms laser, laser device, laser assembly, laser unit and laser system