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## Safety of machinery — Laser processing machines —

Part 3:

### Safety requirements for noise reduction and noise measurement methods for laser processing machines and hand-held processing devices and associated auxiliary equipment (accuracy grade 2)

*Sécurité des machines — Machines à laser —*

*Partie 3: Exigences de sécurité pour la réduction du bruit et pour les méthodes de mesure du bruit des machines lasers, des dispositifs de traitement portatifs et des équipements auxiliaires connexes (classe de précision 2)*

ICS 13.110; 31.260

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## 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.

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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.

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.

Amendment 12 to ISO 11553 1:2007 was prepared by Technical Committee ISO/TC 172, Optics and photonics, Subcommittee SC 9, and by Technical Committee CEN/TC 123, Lasers and photonics in collaboration.

ISO 11553 consists of the following parts, under the general title *Safety of machinery — Laser processing machines*:

- *Part 1: General safety requirements*
- *Part 2: Safety requirements for hand-held laser processing devices*
- *Part 3: Safety requirements for noise reduction and noise measurement methods for laser processing machines and hand-held laser processing devices and associated auxiliary equipment (Accuracy grade 2)*

## Introduction

The Machinery Safety Directive issued by the Council of the EEC outlines essential and mandatory requirements that must be met in order to ensure that machinery is safe. In response, CEN/CENELEC initiated a programme to produce safety standards for machines and their applications. This part of ISO 11553 is one in that series.

It has been prepared as a harmonized standard to provide a means of conforming with the essential safety requirements of the Machinery Directive and associated EFTA Regulations.

This document is a type B standard as stated in ISO 12100-1. The provision of this document may be supplemented or modified by a type C standard.

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

It is applicable to machines using laser radiation to process materials. The purpose of this part of ISO 11553 is to prevent injuries to persons by

- listing potential hazards generated by machines containing lasers,
- specifying safety measures and verifications necessary for reducing the risk caused by specific hazardous conditions,
- providing references to pertinent standards,
- specifying the information which is to be supplied to the users so that they can establish proper procedures and precautions.

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# Safety of machinery — Laser processing machines — Part 3: Safety requirements for noise reduction and noise measurement methods for laser processing machines and hand-held laser processing devices and associated auxiliary equipment (accuracy grade 2)

## 1 Scope

This part of ISO 11553 describes the requirements for noise hazards and specifies all the information necessary to carry out efficiently and under standardized conditions the determination, declaration and verification of airborne noise emission from laser processing machines and hand-held laser processing devices within the scope of ISO 11553 Part 1 and Part 2. It specifies the safety requirements relating to those noise hazards. It specifies noise measurement methods, installation and operating conditions to be used for the test together with the information to be supplied by manufacturers of such equipment.

This standard applies to those laser processing machines and hand-held laser processing devices included in the scope of ISO 11553 Part 1 and Part 2.

Noise emission characteristics include emission sound pressure levels at work stations and where required the sound power level. Declared noise emission values permit comparison of laser processing machines and hand-held laser processing devices on the market.

The use of this noise test code ensures the reproducibility of the determination of the characteristic noise emission values within specific limits. These limits are determined by the accuracy grade of the noise measuring method used. Noise measurements specified by this standard are carried out by the engineering method (accuracy grade 2).

**NOTE** This part of the standard may also be applied to laser processing machines and hand-held laser processing devices being put into service in the semiconductor industry. The noise test code produces the data necessary to aid the claim of conformity to SEMI S2-0706 Environmental, Health, and Safety Guideline for Semiconductor Manufacturing Equipment.

## 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 3744:1994, *Acoustics — Determination of sound power levels of noise sources using sound pressure — Engineering method in an essentially free field over a reflecting plane*

ISO 3746:1995, *Acoustics — Determination of sound power levels of noise sources using sound pressure — Survey method using an enveloping measurement surface over a reflecting plane*

ISO 4871:1996, *Acoustics — Declaration and verification of noise emission values of machinery and equipment*

ISO 9614-2:1996, *Acoustics — Determination of sound-power levels of noise sources using sound intensity — Part 2: Measurement by scanning*

ISO 11201:1995: 1995, *Acoustics — Noise emitted by machinery and equipment — Measurement of emission sound pressure levels at a work station and at other specified positions — Engineering method in an essentially free field over a reflecting plane*

ISO 11202:1995, *Acoustics — Noise emitted by machinery and equipment — Measurement of emission sound pressure levels at a work station and at other specified positions — Survey method in situ*

ISO 11203:1995, *Acoustics — Noise emitted by machinery and equipment — Determination of emission sound pressure levels at a work station and at other specified positions from the sound power level*

ISO 11204:1995, *Acoustics — Noise emitted by machinery and equipment — Measurement of emission sound pressure levels at a work station and at other specified positions — Method requiring environmental corrections*

### 3 Noise hazards

Noise generated by laser processing machines and hand-held laser processing devices can result in:

- a) permanent hearing loss;
- b) tinnitus;
- c) tiredness, stress, head aches;
- d) other effects such as loss of balance, loss of awareness;
- e) interference with speech communication;
- f) inability to hear acoustic warning signals;
- g) etc.

### 4 Safety requirements and measures

#### 4.1 General requirements for noise reduction

Noise reduction shall be an integral part of the design process by specifically taking into account the measures at source as given in ISO TR 11688-1. The success of the applied noise reduction measures is assessed on the basis of the actual noise emission values according to the noise test code specified within this standard in relation to other laser processing machines of a similar application.

#### 4.2 Noise reduction as a safety requirement

Particular considerations shall be given to:

- a) selecting low noise level pumps rather than enclosing the pumps;
- b) releasing of pneumatic energy; to conserve energy, unnecessary releases should be avoided. Silencers or exhaust filters should be considered;
- c) stabilizing vibrating pipelines by special fastenings to reduce noise created by such movements;



- d) laser power generation noise source by the selection of low noise components such as fans or by damper or absorber;
- e) cooling and fume exhaust systems by damping;
- f) preventing vibration of panels by fitting stiffening strips or noise attenuating materials to reduce the radiation of noise (materials used shall conform to IEC 60825-4);
- g) placing noise producing equipment away from the operator position whenever practicable;
- h) applying full and partial acoustic enclosures inside the guard enclosing the process zone to limit the radiation of noise generated by the laser process into the environment.

The success of the applied noise reduction measures is assessed on the basis of the actual noise emission values in relation to other machines of the same family.

The above list is not exhaustive. Alternative technical measures (that may have identical or improved efficiency) for noise reduction can be considered.

## 5 Verification of safety and hygiene requirements and/or protection measures

### 5.1 General requirements

Initial emission sound pressure level measurements may be made using a calibrated sound level meter (conforming to IEC 61672-1 Class 2 (general field)) with operating conditions for the laser processing machine or hand-held laser processing device as specified in Clause A.9 and at a measuring position 1 m from the centre of the operating and control position and 1,6 m above the floor or access level.

If the emission sound pressure level measured is equal to or less than 65 dB – further noise reduction measures, measurements or documentation outlined in this standard are NOT necessary. If the emission sound pressure level measured is greater than 65 dB – the noise reduction measures, measurements, verification and documentation outlined in this standard are necessary.

**NOTE** This test is an approximation using inexpensive measurement equipment to determine if further testing in this standard is required. The approximation is broad enough such that if the laser processing machine or hand-held laser processing device passes this measurement, then conformity to this standard is assured without more precise measurement. If the noise is too great to pass this approximation test then more precise measurement according to this standard is required.

**Table 1 — Verification of safety requirements and/or protective measures**

Clause	Test method
Clause 4	Measurement of noise emission values according to the noise test code shown in Annex A
Clause 6	Verification that a noise emission declaration is given in the instructions