
**Safety of machinery — Reduction
of risks to health resulting from
hazardous substances emitted by
machinery —**

**Part 1:
Principles and specifications for
machinery manufacturers**

*Sécurité des machines — Réduction des risques pour la santé
résultant de substances dangereuses émises par des machines —*

*Partie 1: Principes et spécifications à l'intention des constructeurs de
machines*



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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.

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 WTO principles in the Technical Barriers to Trade (TBT) see the following URL: [Foreword - Supplementary information](#)

The committee responsible for this document is ISO/TC 199, *Safety of machinery*.

This second edition cancels and replaces the first edition (ISO 14123-1:1998), of which, by taking ISO 12100 into account, it constitutes a minor revision.

ISO 14123 consists of the following parts, under the general title *Safety of machinery — Reduction of risks to health resulting from hazardous substances emitted by machinery*:

- *Part 1: Principles and specifications for machinery manufacturers*
- *Part 2: Methodology leading to verification procedures*

Introduction

The structure of safety standards in the field of machinery is as follows:

- a) **type-A standards** (basic safety standards) giving basic concepts, principles for design, and general aspects that can be applied to machinery;
- b) **type-B standards** (generic safety standards) dealing with one safety aspect or one type of safeguard that can be used across a wide range of machinery:
 - type-B1 standards on particular safety aspects (for example, safety distances, surface temperature, noise);
 - type-B2 standards on safeguards (for example, two-hand controls, interlocking devices, pressure-sensitive devices, guards);
- c) **type-C standards** (machine safety standards) dealing with detailed safety requirements for a particular machine or group of machines.

This document is a type-B1 standard as stated in ISO 12100. Its primary purpose is to give guidance to the writers of type-C standards when machines are identified as emitting hazardous substances as a significant risk. This part of ISO 14123 can also be used as guidance in controlling the risk where there is no type-C standard for a particular machine.

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

- machine manufacturers (small, medium and large enterprises);
- 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 enterprises);
- 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 requirements of this document can be supplemented or modified by a type-C standard.

For machines that are covered by the scope of a type-C standard and that have been designed and built according to the requirements of that standard, the requirements of that type-C standard take precedence.

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Safety of machinery — Reduction of risks to health resulting from hazardous substances emitted by machinery —

Part 1: Principles and specifications for machinery manufacturers

1 Scope

This part of ISO 14123 establishes principles for the control of risks to health resulting from hazardous substances emitted by machinery.

This part of ISO 14123 is not applicable to substances that are a hazard to health solely because of their explosive, flammable or radioactive properties or their behaviour at extremes of temperature or pressure.

2 Normative references

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

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

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 12100 and the following apply.

3.1

intended use

use of a machine in accordance with the information for use provided in the instructions

[SOURCE: ISO 12100:2010, 3.23]

3.2

hazardous substance

any chemical or biological agent that is hazardous to health

EXAMPLE Substances or preparations classified as very toxic, toxic, harmful, corrosive, irritant, sensitizing, carcinogenic, mutagenic, teratogenic, pathogenic or asphyxiant. For EU countries, see also Regulation (EC) No 1272/2008^[3].

Note 1 to entry: For the definitions of “chemical agent” and “biological agent”, see EN 1540.

4 Risk assessment

4.1 An identification of hazards and assessment of the foreseeable risks resulting from substances hazardous to health shall be made by the machinery manufacturer. This process shall cover, as far as possible, any potential hazard that can arise from exposure of persons to the machine at any phase of its life cycle.

NOTE Details of the methodology of risk assessment are given in ISO 12100.

4.2 The level of risk depends on the properties of the hazardous substances, the likelihood that personal exposure will occur and the degree of exposure. The health effects of hazardous substances can be

- short-term or long-term, and
- reversible or irreversible.

4.3 Hazardous substances can occur in any physical state (gaseous, liquid, solid) and can affect the body by

- inhalation,
- ingestion,
- contact with the skin, eyes and mucous membranes, or
- penetration through the skin.

4.4 The hazardous substances can be generated from

- any part of a machine,
- substances present in the machine, or
- material arising directly or indirectly from articles and/or substances processed by the machine or used on the machine.

4.5 The phases of the machine life cycle can include the following (see also ISO 12100:2010, 5.4):

- transport, assembly and installation;
- commissioning;
- use;
- all modes of operation, including start-up and shut-down/stopping;
- failure
- setting or process/tool changeover;
- cleaning and housekeeping;
- adjustment;
- maintenance and repair;
- dismantling, disabling and, as far as safety is concerned, scrapping.

5 Types of emissions

5.1 Airborne emissions

5.1.1 Airborne emissions can represent significant sources of exposure to hazardous substances. Inhalation is usually the most significant of all the routes of entry (see 4.3). In addition, airborne emissions can enter the body by other routes, particularly when substances are deposited on a body surface or when they are ingested.

5.1.2 Airborne emissions can arise from various sources, including the following:

- machining, e.g. sawing, grinding, sanding, milling;
- evaporation and thermal convection, e.g. open tanks, crucibles, solvent baths;
- hot-metal processes, e.g. welding, brazing, soldering, profile-cutting, casting;
- material handling, e.g. hopper-charging, pneumatic conveying, sack-filling;
- spraying, e.g. painting, high-pressure cleaning;
- leaks, e.g. at pump seals, flanges;
- byproducts and effluents, e.g. gases from drosses, rubber vulcanization fumes;
- maintenance, e.g. emptying filter bags;
- dismantling processes, e.g. breaking of lead batteries, stripping of asbestos insulation;
- combustion of fuel, e.g. internal combustion engine exhausts;
- apparatus for mixing food;
- metalworking, e.g. nitrosamines from water-soluble metalworking lubricants.

5.1.3 Some examples of airborne hazardous substances are as follows:

- respiratory irritants, e.g. sulfur dioxide, chlorine, cadmium fumes;
- sensitizers, e.g. isocyanates, enzymes, colophon fumes;
- carcinogens, e.g. asbestos, chromium(VI), benzene, vinyl chloride monomer;
- fibrogenic dusts, e.g. free crystalline silica, asbestos, cobalt;
- asphyxiants, e.g. nitrogen, argon, methane;
- biological agents, e.g. *Legionella pneumophila*, dusts from mouldy hay;
- substances that affect specific parts of the body, e.g. mercury (nerve system, kidneys); lead (nerve system, blood); carbon tetrachloride (nerve system, liver); carbon monoxide (blood).

5.1.4 Airborne emissions can be subject to techniques of evaluation based on the measurement of concentrations of substances in the breathing zone of the persons involved. The results of such measurements are usually compared with suitable criteria.

5.1.5 There are many methods of sampling air and analysing the sample for airborne contaminants. Sampling methods and analytical techniques should be selected according to the nature of the airborne contaminant.

5.2 Non-airborne emissions

5.2.1 Non-airborne emissions can be significant sources of exposure to hazardous substances by ingestion, contact with skin, eyes or mucous membranes or penetration through the skin (see [4.3](#)).

5.2.2 Non-airborne emissions can be produced in various circumstances, including the following:

- migration from open sources, e.g. splashing and evaporation/condensation leading to secondary emissions;
- opening machinery, e.g. for maintenance;

- entry into machinery, e.g. for inspection;
- material handling, e.g. charging, sampling, disposal;
- handling machinery parts, e.g. dismantling;
- incorrect operation, e.g. overfilling;
- leaks, e.g. at pump seals, flanges;
- ruptures.

5.2.3 Exposure to non-airborne emissions can cause impairment of health as a result of a variety of hazardous properties associated with different materials. Some examples of these materials include the following:

- corrosives, e.g. sulfuric acid;
- irritants, e.g. wet cement;
- sensitizers, e.g. chromium compounds, epoxy resins;
- carcinogens, e.g. used quenching oil, beryllium oxide, polycyclic aromatic hydrocarbons;
- biological agents, e.g. infected cutting oils, infected blood.

The impairment of health can be local at the point of contact or can be the result of effects elsewhere in the body (systemic or target organ). With some materials, both situations can occur, e.g. phenol.

5.2.4 Non-airborne emissions cannot be evaluated by measurements of concentration of substances in the air. Criteria based on these concentrations cannot be used. Other criteria may be established, e.g. limits regarding microbial concentrations in cutting oils.

5.2.5 In some cases it can be relevant to carry out quantitative assessments of surface contamination. The criteria to be applied should be based on both toxicological and practical considerations. Techniques for measuring such contamination include:

- chemical analyses of wipes,
- use of fluorescent tracers,
- colorimetric indications, and
- count of microorganisms.

6 Requirements and/or protective measures for elimination and/or reduction of risk

Risks from exposure to hazardous substances shall be reduced as far as practical, taking into account scientific and technical methods and limits relating to exposure and the external environment. In selecting the most appropriate risk reduction methods, the manufacturer shall take protective measures to reduce the risks from exposure to hazardous substances as close to the emission source as possible. The manufacturer shall apply the following principles, in the order given, taking into account the state of the art (see also the “three-step method” in ISO 12100:2010, 6.1):

- a) design of machinery to eliminate or prevent risks resulting from exposure to hazardous substances (“inherently safe design measure”);

- b) design of machinery to reduce risks that cannot be eliminated, in the following order of priority (“safeguarding and complementary protective measures”):
- 1) reduction of emission;
 - 2) reduction by ventilation or other engineering means;
 - 3) reduction of exposure by machinery operation or segregation.
- c) information about the residual risks to the user and advice on protective measures to be implemented by the user to reduce exposure.

NOTE A list of possible protective measures is given in [Annex A](#).

7 Information for use and maintenance information

7.1 Information for use

7.1.1 The manufacturer shall state in the instruction manual the intended use of the machine, the hazardous substances that can be generated by the machine (see [4.4](#)) and the operating procedures. The manufacturer shall specify, when necessary, the competence level (achieved by training) required to operate the machine. The manufacturer shall provide in the instruction manual appropriate details of setting and operating conditions of the machine that can result in a reduction of risks.

7.1.2 When the machine is equipped with means of reducing the risk to health, the machinery manufacturer shall supply information on its correct use and factors that can adversely affect its performance.

7.1.3 When there is no such provision of means of reducing the risk to health, methods of reduction and/or testing that are suitable and proven shall be specified by the manufacturer.

7.1.4 If leaks, spills or uncontrolled releases of a hazardous substance can be foreseen, the manufacturer shall provide information to limit the extent of risk to health and to regain adequate control as soon as possible. The information should cover, where appropriate, emergency procedures, safe disposal of the substance and suitable protective equipment to enable the source of release to be safely identified and repairs to be made.

7.1.5 The manufacturer shall provide information on the necessary personal protective equipment and on hygiene arrangements.

7.2 Maintenance information

The machinery manufacturer shall provide sufficient instructions for the maintenance of the machine without risk to health.

NOTE This can include the necessary maintenance to ensure the continuing effective reduction of emissions of hazardous substances. Implementation by the user can be achieved by a structured maintenance programme employing various functional and performance checks at suitable time intervals as far as applicable.

EXAMPLE Such a maintenance programme for the user of a mechanical vibrating screen can include regular checks, as follows, on

- the physical condition of the hardware, including screen covers, inspection hatches, etc. required to maintain the integrity of containment,
- gaskets and seals associated with covers and hatches, to ensure that these are intact and functional,
- flexible connectors on feed and product lines, to ensure that these are still connected and in good condition,

- extraction ventilation, including visual checks, routine mechanical inspection and ventilation performance testing, and
- the accumulation of material.

8 Verification of safety requirements and/or protective measures

A methodology leading to verification procedures for the reduction of risks to health from hazardous substances emitted by machinery is specified in ISO 14123-2.

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