INTERNATIONAL STANDARD

**ISO 10472-1**

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# Safety requirements for industrial laundry machinery —

## Part 1:
Common requirements

*Exigences de sécurité pour les machines de blanchisserie industrielle —*

*Partie 1: Prescriptions communes*



Reference number
ISO 10472-1:1997(E)

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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.

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.

International Standard ISO 10472-1 was prepared by Technical Committee ISO/TC 72, *Textile machinery and machinery for dry-cleaning and industrial laundering*, Subcommittee SC 5, *Industrial laundry and dry-cleaning machinery*.

ISO 10472 consists of the following parts, under the general title *Safety requirements for industrial laundry machinery*:

— *Part 1: Common requirements*

— *Part 2: Washing machines and washer-extractors*

— *Part 3: Washing tunnel lines including component machines*

— *Part 4: Air dryers*

— *Part 5: Flatwork ironers, feeders and folders*

— *Part 6: Ironing and fusing presses*

Annex A forms an integral part of this part of ISO 10472. Annexes B and C are for information only.

## Introduction

ISO 10472 is intended to instruct the designer of industrial laundry machinery in a systematic manner, focusing on his particular type of machine, regarding the relevant essential safety requirements, and to suggest possible state-of-the-art safety solutions.

The extent to which hazards are covered is indicated in the scope of this part of ISO 10472. The manufacturer's attention is drawn to the fact that machinery should comply as appropriate with ISO/TR 12100-1 and ISO/TR 12100-2 for hazards which are not specifically referred to in this part of ISO 10472.

All examples given in ISO 10472 represent the state of the art. Equivalent solutions are acceptable, provided they attain at least the same safety level.

# Safety requirements for industrial laundry machinery —

# Part 1:
Common requirements

## 1 Scope

The individual parts of ISO 10472 identify all significant hazards associated with laundry machinery designed for use in industrial laundry premises, which includes hotels, hospitals, nursing homes, prisons and similar premises, as well as machines designed for use in self-service establishments subject to the minimum capacities stated in the separate parts of ISO 10472. Dry-cleaning presses and garment presses are also included.

Certain specialized finishing machines used for shaped items are excluded.

Household and similar electrical appliances (see IEC 335) are not covered by ISO 10472.

The individual parts of ISO 10472 complement the basic requirements laid down in ISO/TR 12100-1 and ISO/TR 12100-2. They give guidance to the designer on assessing the risks associated with the hazards (see EN 1050) and on selecting measures to attain the required safety level. "Use of machinery" comprises both intended use and reasonably foreseeable misuse.

The individual parts of ISO 10472 do not give specific technical advice about:

— the phases of life of the machine other than use;

— noise;

— laser;

— maintenance operations and elimination of process faults;

— ergonomics;

— explosions;

— isolation of energy sources;

— pressure vessels;

— hot surfaces necessarily exposed for production purposes [but see ISO 10472-6 (press head surface)].

The individual parts of ISO 10472 do not cover electromagnetic compatibility.

Hazards due to the use of gas within a machine which is not included in the range described in 5.5.2 of this part of ISO 10472 are not covered by the individual parts of ISO 10472.

Examples of layouts of a large- and a medium-size plant which show the machines of parts 2 to 6 of ISO 10472 are given in annex B.

The individual parts of ISO 10472 apply to machines which are manufactured after the date of issue of the relevant parts.

NOTE — For significant hazards concerned with construction, transport, commissioning, decommissioning, dismantling and disposal of the machine, see ISO/TR 12100-1:1992, 3.11, 3.12 and ISO/TR 12100-2:1992, 5.5.

The guidance contained in the individual parts of ISO 10472 is based on the assumption that the designer has completed a risk analysis of the machine under consideration. This will enable him to identify and fulfil the significant requirements for the machine as stipulated by the individual parts of ISO 10472.

## 2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this part of ISO 10472. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreement based on this part of ISO 10472 are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 5232:—[1], *Graphical symbols for textile machinery.*

ISO 9398-1:1993, *Specifications for industrial laundry machines — Definitions and testing of capacity and consumption characteristics — Part 1: Flatwork ironing machines.*

ISO 9398-2:1993, *Specifications for industrial laundry machines — Definitions and testing of capacity and consumption characteristics — Part 2: Batch drying tumblers.*

ISO 9398-3:1993, *Specifications for industrial laundry machines — Definitions and testing of capacity and consumption characteristics — Part 3: Washing tunnels.*

ISO 9398-4:1993, *Specifications for industrial laundry machines — Definitions and testing of capacity and consumption characteristics — Part 4: Washer-extractors.*

ISO 10472-2:1997, *Safety requirements for industrial laundry machinery — Part 2: Washing machines and washer-extractors.*

ISO 10472-3:1997, *Safety requirements for industrial laundry machinery — Part 3: Washing tunnel lines including component machines.*

ISO 10472-4:1997, *Safety requirements for industrial laundry machinery — Part 4: Air dryers.*

ISO 10472-5:1997, *Safety requirements for industrial laundry machinery — Part 5: Flatwork ironers, feeders and folders.*

ISO 10472-6:1997, *Safety requirements for industrial laundry machinery — Part 6: Ironing and fusing presses.*

ISO/TR 12100-1:1992, *Safety of machinery — Basic concepts, general principles for design — Part 1: Basic terminology, methodology.*

ISO/TR 12100-2:1992, *Safety of machinery — Basic concepts, general principles for design — Part 2: Technical principles and specifications.*

ISO 13849-1:—[2], *Safety of machinery — Safety related parts of control systems — Part 1: General principles for design.*

ISO 13850:1996, *Safety of machinery — Emergency stop — Principles for design.*

ISO 13851:—[2], *Safety of machinery — Two-hand control devices — Functional aspects and design principles.*

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1) To be published. (Revision of ISO 5232:1988)

2) To be published.

ISO 13852:1996, *Safety of machinery — Safety distances to prevent danger zones being reached by the upper limbs.*

ISO 13853:—[2], *Safety of machinery — Safety distances to prevent danger zones being reached by the lower limbs.*

ISO 14119:—[2], *Safety of machinery — Interlocking devices associated with guards — Principles for design and selection.*

IEC 335-1:1991, *Safety of household and similar electrical appliances — Part 1: General requirements.*

IEC 335-2-7:1993, *Safety of household and similar electrical appliances — Part 2: Particular requirements for washing machines.*

IEC 335-2-11:1993, *Safety of household and similar electrical appliances — Part 2: Particular requirements for tumbler dryers.*

IEC 335-2-44:1987, *Safety of household and similar electrical appliances — Part 2: Particular requirements for electric ironers.*

EN 563:1994, *Safety of machinery — Temperatures of touchable surfaces — Ergonomics data to establish temperature limit values for hot surfaces.*

EN 614-1:1995, *Safety of machinery — Ergonomic design principles — Part 1: Terminology and general principles.*

EN 746-2:1997, *Industrial thermoprocessing equipment — Part 2: Safety requirements for combustion and fuel handling systems.*

EN 953:1997, *Safety of machinery — General requirements for the design and construction of fixed and movable guards.*

EN 999:—[2], *Safety of machinery — Hand/arm speed — Approach speed of parts of the body for the positioning of safety devices.*

EN 1037:1995, *Safety of machinery — Prevention of unexpected start-up.*

EN 1760-1:1997, *Safety of machinery — Pressure sensitive protective devices — Part 1: General principles for the design and testing of pressure sensitive mats and sensitive floors.*

EN 1760-2:—[2], *Safety of machinery — Pressure sensitive protective devices — Part 2: General principles for the design and testing of pressure sensitive edges and pressure sensitive bars.*

EN 50100-1:—[2], *Safety of machinery — Electro-sensitive protective devices — Part 1: General requirements and tests.*

EN 60204-1:1992, *Safety of machinery — Electrical equipment of machines — Part 1: General requirements.* [IEC 204-1:1992, modified]

## 3 Definitions

For the purposes of this part of ISO 10472, the definitions given in ISO 10472-2 to ISO 10472-6 and the following definition apply.

2) To be published.

**3.1**
**industrial laundry machinery**
Machines used for the purpose of washing, extracting, drying or finishing of flat and shaped textile items in an industrial laundry.

NOTE — This definition includes machines intended for use in hotels, hospitals, nursing homes, prisons and similar premises.

## 4 Significant hazards connected with most industrial laundry machinery

### 4.1 Mechanical hazards:

— crushing;
— shearing;
— entanglement;
— drawing-in or trapping;
— impact;
— high pressure fluid ejection;
— slipping, tripping and falling.

### 4.2 Electrical hazards:

— electrical contact, direct or indirect.

### 4.3 Thermal hazards:

— incidental or intended contact with hot surfaces, flames or explosions and also radiation from heat sources;
— health-damaging effects of hot or cold working environments.

### 4.4 Hazards generated by noise:

— hearing loss (deafness);
— other physiological disorders (e. g. loss of balance, loss of awareness).

### 4.5 Hazards associated with materials and substances processed, used or exhausted by machinery:

— contact with or inhalation of harmful fluids, gases, mists, fumes and dusts;
— fire and explosion;
— decomposition of substances (e. g. by a naked flame);
— biological hazards.

### 4.6 Hazards due to neglect of ergonomic principles in machine design:

— unhealthy posture in case of inadequate height of feeding and unloading equipment.

### 4.7 Failure of energy supply, breakdown of machinery parts and other malfunction:

— failure of energy supply (of energy and/or control circuits);

— failure/malfunction of control system (unexpected start-up, unexpected overrun).

### 4.8 Hazards arising during maintenance and/or elimination of process faults

## 5 Safety requirements and/or measures for the hazards identified in clause 4

### 5.1 Mechanical hazards

#### 5.1.1 Escape and rescue of trapped persons

Where there is a residual risk of entrapment, for example due to malfunction of a safety device or during maintenance, the manufacturer shall provide means and instructions for releasing an entrapped person to minimize injury.

EXAMPLES

— reversal of a roller ironer;
— separation of roll and bed;
— dismantling of the mechanism of a scissor press.

#### 5.1.2 Guards and safety devices

The following safety requirements and/or measures apply. For guards, see table 1, for safety devices, see table 2.

The instruction handbook shall state that the machine shall not be operated until the fixed guards are put correctly in place.



**Table 1 — Safety requirements and/or measures for guards**

| Application | Reference |
|---|---|
| Guard selection, unless specified in ISO 10472-2 to ISO 10472-6 | ISO/TR 12100-2:1992, 4.1<br>EN 953:1997, clause 5 |
| Guard design and construction | ISO/TR 12100-2:1992, 4.2<br>EN 953:1997, clauses 6 and 7 |
| Guard fastening | EN 953:1997, 5.4, 7.2 and 7.3 |
| Guard arrangement, unless specified in ISO 10472-2 to ISO 10472-6[1)] | ISO 13852:1996, tables 1 and 4<br>ISO 13853 |
| Guard interlocking, unless specified in ISO 10472-2 to ISO 10472-6 | ISO 14119:—, clause 5 |
| Fence guard | annex A |
| 1) The safety distances for guards shall apply to all operating positions for normal operation as well as setting, adjustment, maintenance work, and elimination of process faults. | |

**Table 2 — Safety requirements and/or measures for safety devices**

| Application | Reference |
|---|---|
| Selection of safety devices, unless specified in ISO 10472-2 to ISO 10472-6 | ISO/TR 12100-2:1992, 4.1 |
| Technical characteristics of safety devices | ISO/TR 12100-2:1992, 4.2.3<br>EN 50100-1:—, clause 4 |
| Positioning of safety devices unless specified in ISO 10472-2 to ISO 10472-6[1)] | EN 999:—, clauses 5 to 7 |
| Interlocking guard<br>- selection<br>- design | ISO 14119:—, 3.2<br>ISO 14119:—, 7.5<br>ISO 14119:—, clauses 5 and 6 |
| Interlocking guard with guard locking<br>- selection<br>- design | ISO 14119:—, 3.3<br>ISO 14119:—, 7.5<br>ISO 14119:—, 5.3<br>EN 50100-1:—, A5, A6, A8 |
| Electrosensitive protective devices,<br>- selection[2)]<br><br>- installation<br>- when used for start-up | <br>EN 50100-1:—, clause 4<br>ISO 13849-1:—, 4.3<br>EN 50100-1:—, annex C<br>EN 50100-1:—, A5 |
| Photoelectric protective devices<br>- selection[2)]<br>- positioning | <br>EN 50100-1:—, clause 4<br>EN 999:—, clause 6, 6.1 to 6.4 |
| Two-hand controls<br>- selection[3)] | ISO 13851:—, clause 5<br>EN 60204-1:1992, 9.2.5.7<br>ISO 13849-1:—, 4.3 |
| Pressure-sensitive protective devices | EN 1760-1:1997, clause 4<br>EN 1760-2: —, clause 4 |
| Hold-to-run control devices[4)] | ISO/TR 12100-1:1992, 3.23.3<br>EN 60204-1:1992, 9.2.5.6 |

1) The safety distances for safety devices shall apply to all operating positions for normal operation as well as setting, adjustment, maintenance work, and elimination of process faults.

2) Type 2 shall be used unless specified in ISO 10472-2 to ISO 10472-6.

3) Type II shall be used unless specified in ISO 10742-6.

4) This device shall be positioned so that the operator can clearly see but not reach the danger zone(s).

#### 5.1.3 Fault-finding, cleaning or maintenance

For fault-finding, cleaning or maintenance (e. g. clearing of blockages), safety measures in accordance with ISO/TR 12100-2:1992, 3.7.10 shall be taken and described in the instruction handbook.

#### 5.1.4 Complex installation

For complex installations comprising a combination of machines and service equipment, arranged to work as one integrated production unit and subject to an overall control system, the following safety requirements and/or measures shall be taken:

a) there shall be a power supply disconnecting device (master isolator) for the entire complex installation, and each machine or section shall be provided with individual power supply disconnecting devices, where such can be operated individually (see EN 1037:1995, 4.1); and

b) additional guards and safety devices shall be installed as necessary for either the complex installation in its entirety or on individual constituent machines, together with the interfaces between any given machine and those adjoining; and

c) all movable guards and safety devices shall be in position and activated before it is possible to start the entire complex installation for normal operation. It is permitted to have guards and safety devices out of position or inactivated on any constituent machine whilst it is purposely inoperative and at standstill, provided that access to dangerous parts on adjacent operating machines is prevented; and

d) in the case of a machine, or a combination of machines, comprising unit items selected from the proprietary range of products of two or more manufacturers, it shall be ensured that a comprehensive complement of safety measures is provided by the party responsible for the overall installation according to how this responsibility is defined in the ruling contract(s). Particular attention shall be given to the interfaces between the unit items.

NOTE – Failure to complete the overall assessment of hazards and risks arising from the entire assembly of components may lead to an insufficient level of safety for the whole installation.

### 5.2 Electrical hazards

The electrical equipment of machines shall be designed in accordance with EN 60204-1:1992, option 1, or IEC 335 [see b)] as specified in 5.3 of ISO 10472-2:1997, ISO 10472-4:1997 and ISO 10472-5:1997, depending on the intended use of the machine.

a) If EN 60204-1 applies, the appropriate clauses given in table 3 shall be used.

   These machines shall be equipped with an emergency stop device in accordance with ISO 13850:1996, 4.1.5 - category 0, unless specified otherwise in ISO 10472-2 to ISO 10472-6. The manufacturer shall fit emergency stop devices as required in ISO 13850:1996, 4.4 and at each loading and unloading position.

   In addition, the manufacturer shall ensure that there are sufficient devices so that at least one is visible from any normal operator access area within 2 m from the machine, and that each device is located within 8 m of any such operator position. If the device is an emergency stop button, it shall be positioned at a height from the working floor or platform of between 700 mm and 1700 mm.

   This emergency stop device may be omitted on machines designed for coin, token or similar operation for use in self-service situations; in such cases, the instruction handbook shall describe the arrangement for a remote-located emergency stop device, which shall be provided by the user and connected to each machine.

**Table 3 — Safety requirements for electrical equipment of machines (EN 60204-1)**

| Safety requirements and/or measures concerning: | See EN 60204-1:1992, clause: |
|---|---|
| Electric shock | 4, 6, 7, 8, 13, 15, 16 and 18 |
| Overcurrent, overspeed and overload | 7 and 8 |
| Environmental influences | 4, 13 and 16 |
| Electromagnetic compatibility | 4, 8 and 9 |
| Restart after voltage drop or supply interruption | 7.5 |
| Accessibility, layout and identification of control equipment | 10, 13 and 18 |
| Ergonomics for manual operation | 10 and 13 |
| Cabling and wiring | 14 and 15 |
| Accessories and lighting | 17 |
| Documentation and instruction handbook | 19 |
| Testing | 20 |
| Degrees of protection | 13.3 |



b) If IEC 335 applies, the following parts shall be used:

— IEC 335-1:1991 for all machines;
— IEC 335-2-7:1993 for washing machines;
— IEC 335-2-11:1993 for tumble dryers;
— IEC 335-2-44:1987 for ironers.

The designer shall select the appropriate standard and use only the clauses dealing with electrical safety.

For IEC 335 the appropriate clauses given in table 4 shall apply.

**Table 4 — Safety requirements for electrical equipment of machines (IEC 335)**

| Safety requirements and/or measures concerning: | IEC 335-1:1991, clause | IEC 335-2-7:1993, clause | IEC 335-2-11:1993, clause | IEC 335-2-44:1987, clause |
|---|---|---|---|---|
| Electric shock | 8 | 8 | 8 | 8 |
| Start / input / current | 9, 10 | 9, 10 | 9, 10 | 9, 10 |
| Heat | 11 | 11 | 11 | 11 |
| Insulation | 13, 15, 16 | 13, 15, 16 | 13, 15, 16 | 13, 15, 16 |
| Overload | 17 | 17 | 17 | 17 |
| Wiring | 23 | 23 | 23 | 23 |
| Components | 24 | 24 | 24 | 24 |
| Connections, terminals, earthing | 25, 26, 27 | 25, 26, 27 | 25, 26, 27 | 25, 26, 27 |
| Insulation distances | 29 | 29 | 29 | 29 |
| NOTES<br>1 The requirements of EN 60204-1:1992, clauses 19 and 20 shall also apply.<br>2 The designer should note that national regulations concerning the electrical equipment may apply to this range of machines. | | | | |



## 5.3 Thermal hazards

When a machine contains parts that could create burn hazards, the equipment shall be designed so as to minimize the risk of burn injury caused by contact with or proximity to machine parts at high temperatures. This can be achieved when the surface temperatures for incidental contact (less than 1 s contact time) do not exceed the following values under normal processing conditions, unless otherwise specified in ISO 10472-2 to ISO 10472-6:

— uncoated metal: 70°C
— coated metal (e.g. paint thickness 60 µm): 80°C
— glass: 85°C

} not including process surfaces

For machines that may occasionally process at higher temperatures, the manufacturer shall describe in the instruction handbook these particular circumstances and give advice to the user for staff training and preparation of safety instructions.

For exposed processing surfaces, e. g. ironer beds or press heads, particular measures are not described. See clause 1.

For deliberate contact surfaces, e. g. manual valves and door handles, means shall be provided to ensure that the surface temperatures do not exceed those given in EN 563 for 10 s contact.

The instruction handbook shall draw attention to the risk to maintenance staff of exposure to thermal hazard when guards or shields are removed.

## 5.4 Hazards generated by noise

ISO 10472 does not contain specific measures concerning noise reduction. At an early stage of design, consideration should be given to the possible noise hazard likely to arise. The selection of appropriate measures should be based on the latest technology (see ISO/TR 11688-1).

## 5.5 Hazards associated with materials and substances

### 5.5.1 Contact with or inhalation of harmful fluids, gases, mists, fumes and dusts

The instruction handbook shall contain information concerning the correct use of the machine to prevent exposure to harmful substances (see EN 626-1). It shall also require the user to consult with the chemical supplier as to the risk of the products used and their combinations. See the appropriate parts of ISO 10472 for specific measures.

### 5.5.2 Fire and explosion

For the following range of machines, the requirements of EN 746-2 shall apply:

— machines as defined in ISO 10472-2 having a net usable cage volume[3] ≥ 150 l;

— all machines described in ISO 10472-3;

— machines as defined in ISO 10472-4 having a net usable cage volume[3] ≥ 350 l;

— machines described in ISO 10472-5 having a surface contact area ≥ 1,2 m² (under pressure for bed ironer);

— all machines described in ISO 10472-6.

For these machines the appropriate clauses given in table 5 shall apply.



3) See ISO 9398-4:1993, 3.2.

**Table 5 — Safety requirements for heating equipment**

| Safety requirements concerning: | See EN 746-2:1997, clause |
|---|---|
| Heating with gaseous fuels<br>Heating with liquid fuels | 5.1<br>5.2 |
| Verification | 5 |
| Instruction handbook and marking | 6 |

Purging for direct-fired machines shall be in accordance with EN 746-2:1997, 5.2.1.9, 5.2.3.2, 5.3.1.9 and 5.3.3.2, but the purging volume shall be not less than three times the volume of the hot air in the machine. Associated ducting shall not be included in this calculation.

The manufacturer shall explain in the instruction handbook the possible hazard due to unburnt gas and lint remaining in the exhaust ducting, and describe measures that may be taken by the user depending on the design of the duct.

The manufacturer shall provide means to shut off the fuel supply in the event that the exhaust system is impeded so as to create a hazardous situation (e. g. a shut-off valve interlocked with the pressure sensor in the exhaust system). Details shall be given in the instruction handbook concerning the ducting of exhaust gases to a safe external location, also any requirement for additional purge times for long ducting.

NOTE — For machines below the size limits described above, national regulations concerning safety of gas appliances may apply.

### 5.5.3 Decomposition of substances

For gas- and oil-fired machines, the manufacturer shall include a warning in the instruction handbook that some substances, for example dry-cleaning solvents, may decompose into toxic and/or corrosive substances if drawn into the burners, and that ducting for gas- and oil-fired machines should lead to a safe external location.

### 5.5.4 Biological hazards

The manufacturer shall advise the user in the instruction handbook of biological hazards from the non-completion of a disinfection cycle.

NOTE — National regulations concerning disinfection may exist.

## 5.6 Hazards due to neglect of ergonomic principles in machine design

ISO 10472 does not contain specific measures about elimination or reduction of hazards due to neglect of ergonomic principles in machine design. Advice is given in EN 614-1:1995, annex A, for avoiding unhealthy postures.

### 5.7 Failure of energy supply and control systems

#### 5.7.1 Failure of energy supply

Means shall be provided to prevent risks as a result of failure of the energy supply.

EXAMPLES
— power-released spring-loaded mechanical braking on hazardous rotation;
— power-released spring-loaded guard locking [see ISO 14119:—, figure 4 a)].

#### 5.7.2 Failure of control systems

The safety-related part of the control system shall be designed using reliable components and principles (category 1) unless a higher category is specified in ISO 10472-2 to ISO 10472-6 (see ISO 13849-1:—, clause 6).

### 5.8 Hazards arising during maintenance and/or elimination of process faults

For maintenance operations and elimination of process faults (e. g. removal of entangled linen), the safety requirements and/or measures given in ISO/TR 12100-2:1992, 3.7.8, 3.7.9, 3.7.10 and 4.1.4 apply.

Adjustment, lubrication and maintenance points shall, where possible, be located outside danger zones. The machine shall be so designed that, wherever possible, adjustments, maintenance, repair, tuning, setting, cleaning, servicing operations and elimination of process faults can be carried out while the machine is at standstill and totally isolated from all dangerous sources of motive power. The appropriate parts of ISO 10472 describe specific safety requirements and/or measures for machines on which special operations cannot be carried out at standstill (e. g. clothing of ironing rollers).

## 6 Verification of safety requirements and/or measures

The verification clauses of ISO 10472-2 to ISO 10472-6 and other normative references shall apply.

Aspects of machine design and construction can be subject to verification by inspection, calculation and testing. Final verification shall be accomplished in a fully commissioned condition by checking that:

— all standards referred to in clause 5 are interpreted correctly;

— all verification procedures required by normative references have been completed correctly;

— particular specifications (e. g. velocities, forces, *G* factor calculations) are correct;

— all guards and safety devices are in place, effective, and adequately dimensioned;

— the instruction handbook contains all the required information.

Table 6 gives a list of verifications.

**Table 6 — List of verifications**

| Sub-clause | Subject | Reference | Test method |
|---|---|---|---|
| 5.1 | Mechanical hazards | | |
| 5.1.1 | Entrapped persons | Instruction handbook | Confirm accuracy and content |
| 5.1.2 | Guards | ISO/TR 12100-2<br>EN 953<br>ISO 13852<br>ISO 13853<br>Instruction handbook | Inspection and test<br>Visual inspection<br>Measurement<br>Measurement<br>Confirm accuracy and content |
| | Interlocking devices | ISO 14119 | Test and inspection |
| | Safety devices | ISO/TR 12100-2<br>ISO 13851<br>EN 50100-1<br>EN 999 | Inspection and test<br>Demonstration<br>Demonstration<br>Measurement and demonstration |
| 5.1.3 | Fault finding | ISO/TR 12100-2<br>Instruction handbook | Confirm accuracy and content |
| 5.1.4 | Complex installation<br>a) master isolator<br>b) guards and safety devices<br>c) start of complex installation<br>d) overall installation | <br>EN 1037<br><br><br>Ruling contract(s) | <br>Inspection and test<br>Inspection<br>Function test<br>Confirm accuracy and content |
| 5.2 | Electrical hazards | | |
| | Items mentioned in table 3 | EN 60204-1 | |
| | Emergency stop devices | ISO 13850 | Visual inspection, measurement, function test |
| | Emergency stop for self service, remote location | Instruction handbook | Confirm accuracy and content |
| | Items mentioned in table 4 | IEC 335 | |
| 5.3 | Thermal hazards | | |
| | Temperature of hot surfaces | | Measurement |
| | Higher temperatures | Instruction handbook | Confirm accuracy and content |
| | Deliberate contact surfaces | EN 563 | Measurement |
| | Maintenance staff | Instruction handbook | Confirm accuracy and content |

**Table 6** *(continued)*

| Sub-clause | Subject | Reference | Test method |
|---|---|---|---|
| 5.5.1 | Harmful fluids, gases, mists, fumes, dusts | | |
| | Correct use of the machine | Instruction handbook | Confirm accuracy and content |
| | Consultation with chemical supplier | Instruction handbook | Confirm accuracy and content |
| 5.5.2 | Fire and explosion | | |
| | Combustion equipment | EN 746-2:1997, clause 6 | |
| | Purging for direct fired machines | EN 746-2:1997, 5.2.1.9, 5.2.3.2, 5.3.1.9 and 5.3.3.2 | Calculation of purging volume |
| | Unburnt gas and lint | Instruction handbook | Confirm accuracy and content<br>Demonstration |
| | Shut-off means | Instruction handbook | Confirm accuracy and content |
| 5.5.3 | Decomposition of substances | | |
| | Warning | Instruction handbook | Confirm accuracy and content |
| 5.5.4 | Biological hazards | Instruction handbook | Confirm accuracy and content |
| 5.7.1 | Failure of energy supply | ISO 14119 | Disconnect energy supply<br>Check safety functions |
| 5.7.2 | Failure of control systems | | |
| | Categories | ISO 13849-1:—, clause 6 | Check manufacturer's technical file |
| 5.8 | Maintenance and elimination of process faults | | |
| | Maintenance operations | ISO/TR 12100-2 | |
| | Location of lubrication and maintenance points | | Visual inspection |
| 7.1 | Instruction handbook | ISO/TR 12100-2: 1992, 5.5 | Check completeness |
| 7.2 | Marking | SO/TR 12100-2: 1992, 5.4<br>ISO 5232 | Visual inspection |

**Table 6** *(concluded)*

| Sub-clause | Subject | Reference | Test method |
|---|---|---|---|
| Annex A | Fence guard | | |
| | Dimensions | ISO 13852<br>ISO 13853 | Measurement<br>Measurement |
| | Height, clearance | | Measurement |
| | Interlocked doors<br>- access time, stopping time | ISO 14119 | Demonstration<br>Measurement |
| | Restarting | | Check position and function of control panel |
| | - reset controls | | Check position and function and locking means |
| | Trip devices<br>- category | 5.1.2, table 2<br>5.7.2 | Check manufacturer's technical file |
| | Door opening from inside only | | Demonstration |

## 7 Information concerning machine use

### 7.1. Instruction handbook

The manufacturer shall provide an instruction handbook as described in ISO/TR 12100-2:1992, 5.5.

The manufacturer shall provide information on noise emission in accordance with ISO/TR 12100-2:1992, A. 1.7.4.

In addition to the information required in ISO/TR 12100-2, the manufacturer shall provide the following details:

— a clear statement of the range of application of the machine and any limitations of use, in particular the processes for which the machine may or may not be employed;

— a clear statement of the maximum and minimum pressures, rates and nature of any supplies provided to the machine;

— a full description of the normal safe procedure to operate the machine, together with explanatory diagrams if necessary. This description shall take into account the operators' movement to reduce fatigue, e. g. repetitive strain injury (see EN 614-1);

— a description of a safe system of work for frequent maintenance duties, setting, elimination of process faults (e. g. replacement of machine clothing, clearing blockages);

— a description of the characteristics required for any special ventilation, exhaust or drainage to conduct noxious substances;

— where the machine forms a component of a process line, the manufacturer shall describe the residual risks and give information concerning the interfaces with other equipment.

The manufacturer shall provide detailed instruction as required in clause 5 concerning:

— 5.1.1, safety measures for the escape and rescue of trapped persons;
— 5.1.2, machine not to be operated without fixed guards;
— 5.1.3, methods for fault finding, cleaning or maintenance;
— 5.2, remote-located emergency stop;
— 5.3, thermal hazards;
— 5.5.1, hazardous emissions;
— 5.5.2, ducting of exhaust gases;
— 5.5.3, warning of toxic gases;
— 5.5.4, biological hazards.

The manufacturer shall provide information required by other normative references, e. g.

EN 60204-1:1992
— clause 19: Instruction handbook;
— clause 20: Safety check procedures.

EN 746-2:1997
— clause 5: Safety check procedures;
— clause 6: Instruction handbook.

The manufacturer shall describe the safe method of handling the machines during installation and dismantling.

### 7.2 Warning signs

The manufacturer shall provide machine marking in accordance with ISO/TR 12100-2:1992, 5.4, EN 60204-1:1992, clauses 18 and 19, EN 746-2, ISO 9398-1 to ISO 9398-4.

Graphical symbols shall comply with ISO 5232.

The machine shall be clearly marked with the total mass, lifting points and centre of gravity.

# Annex A
(normative)

## Additional specification for fence guards

To prevent access to danger points, the dimensions of the fence guards shall be in accordance with ISO 13852 and ISO 13853. Additionally, the height shall be at least 1800 mm and the clearance between the lower edge of the fence guards and the floor shall not exceed 180 mm in order to reduce the possibility of unauthorized access.

Where doors are provided to permit access through the fence enclosure, these shall be interlocked, see ISO 14119. Where the stopping time exceeds the access time, guard locking shall be provided.

The machine shall only be restarted by actuating the start control at the control panel. To prevent restart by any unauthorized person, a reset control shall be provided near the door(s) which enables all danger zones to be observed. Restart shall not be possible until the reset control has been actuated.

Alternatively, trip devices such as pressure-sensitive mats or floors (see table 2) and also electrosensitive protective devices (see table 2) may be used to prevent the machine being restarted as long as persons are within the fence guard. The safety-related part of the control system of these trip devices shall have the same category as the safety-related control system of the fence guard.

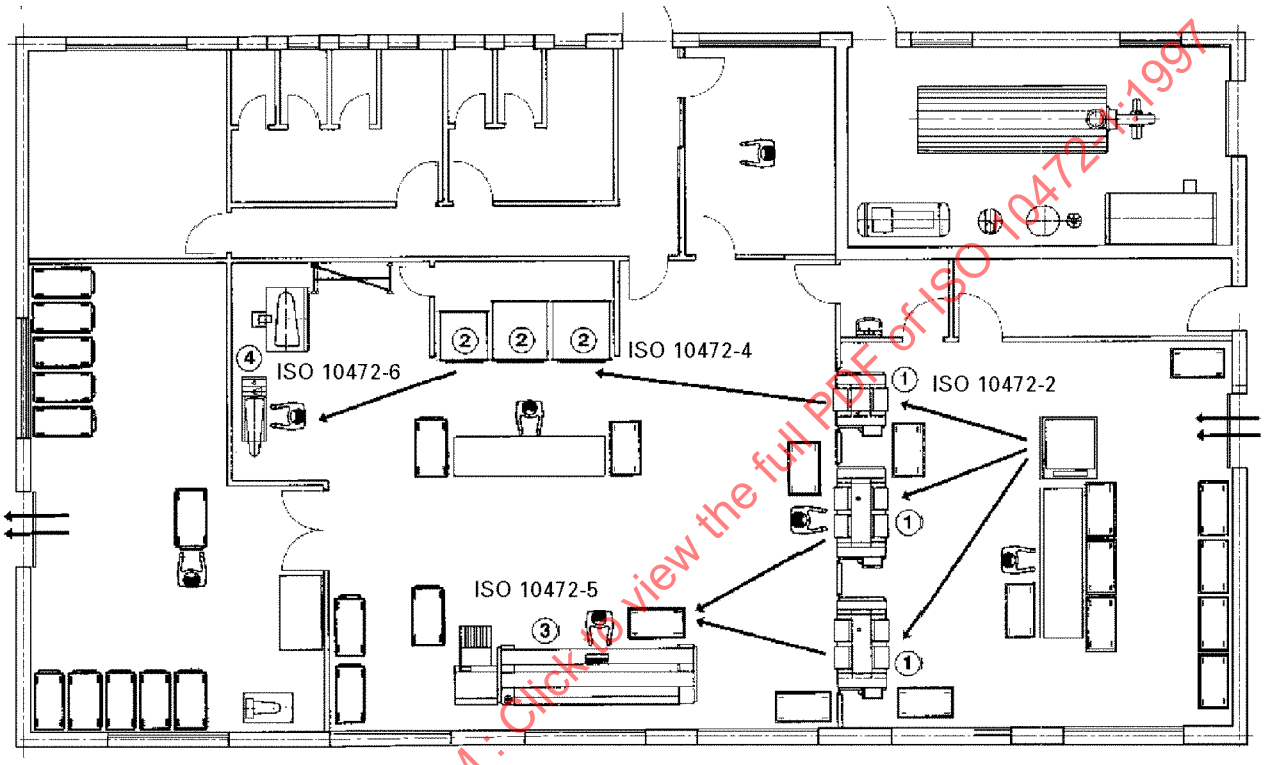
Doors shall be designed so that they can be opened from the inside.

If two or more doors are provided for access through the fence guard, each door shall be fitted with an independent reset control. The machine shall only be restarted from the main control panel.

A reset control shall be provided with independent locking means for each operator inside the guards. The machine shall only be restarted when each operator has unlocked his reset control.

# Annex B
(informative)

## Layouts of plants




**Key**

1 Washer extractor (barrier machine)
2 Tumble dryer
3 Cylinder ironer (multi-function machine)
4 Ironing press (scissor press)

**Figure B.1 — Layout of medium-size plant**