
**Safety requirements for industrial laundry
machinery —**

**Part 4:
Air dryers**

*Exigences de sécurité pour les machines de blanchisserie industrielle —
Partie 4: Séchoirs à air*
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International Organization for Standardization
 Case postale 56 • CH-1211 Genève 20 • Switzerland
 Internet central@iso.ch
 X.400 c=ch; a=400net; p=iso; o=isocs; s=central

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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 10472-4 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*

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Introduction

This part of 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. In addition, 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 this part of ISO 10472 represent the state of the art. Equivalent solutions are acceptable, provided they attain at least the same safety level.

The designer is presumed to have taken into account all the provisions of ISO 10472-1 before considering this part of ISO 10472.

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Safety requirements for industrial laundry machinery —

Part 4: Air dryers

1 Scope

This part of ISO 10472 covers, together with ISO 10472-1, most significant hazards associated with air dryers, and in particular with tumble dryers having a net usable cage volume > 160 l and tunnel finishers including associated conveyors and cabinet dryers.

This part of ISO 10472 complements the basic requirements as laid down in ISO/TR 12100-1 and ISO/TR 12100-2. It also gives guidance to the designer on assessing the risks associated with the hazards (see EN 1050) and on selecting measures for attaining the required safety level.

This part of ISO 10472 does not apply to ancillary equipment.

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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 6182-1:1993, *Fire protection — Automatic sprinkler systems — Part 1: Requirements and test methods for sprinklers.*

ISO 10472-1:1997, *Safety requirements for industrial laundry machinery — Part 1: Common requirements.*

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:—¹⁾, *Safety of machinery — Safety-related parts of control systems — Part 1: General principles for design.*

ISO 13853:—¹⁾, *Safety of machinery — Safety distances to prevent danger zones being reached by the lower limbs.*

ISO 14119:—¹⁾, *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.*

1) To be published.

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

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 guards (fixed, movable).*

EN 982:1996, *Safety of machinery — Safety requirements for fluid power systems and components — Hydraulics.*

EN 983:1996, *Safety of machinery — Safety requirements for fluid power systems and components — Pneumatics.*

EN 1050:1996, *Safety of machinery — Risk assessment.*

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

EN 1760-2:—¹⁾, *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:—¹⁾, *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]

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3 Definitions

ISO 10472-4:1997

For the purposes of this part of ISO 10472, the following definitions apply:
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3.1

tumble dryer

Machine for moisture extraction from a load of damp textile material by tumbling in a rotating cage in an atmosphere of hot air produced by the tumble dryer.

NOTE — It may also be used to agitate the loads mechanically without hot air.

3.1.1

front-loaded tumble dryer

Tumble dryer in which the plane of the loading door is at a right angle to the axis of rotation of the cage.

3.1.2

pass-through tumble dryer

Tumble dryer having the loading and unloading doors on opposite sides.

3.1.3

tilting tumble dryer

Tumble dryer which tilts for loading and/or unloading.

3.1.4

automatic tilting tumble dryer

Tilting tumble dryer with the tilting motion to load and unload, and opening and closing doors, under automatic (not manual) control.

1) To be published.

3.2

tunnel finisher

Machine for the drying and finishing of shaped garments within which damp garments arranged on hangers are loaded onto an overhead conveyor for transport through the machine in an atmosphere of high humidity followed by an atmosphere of hot dry air produced by tunnel finisher.

3.3

cabinet dryer

Heated cabinet within which shaped garments are suspended on hangers for the purpose of drying, without being conveyed during the drying cycle.

4 Hazards

4.1 General

The hazards common to most industrial laundry machinery are listed in ISO 10472-1. Significant particular hazards found in air dryers are listed in 4.2 to 4.7.

4.2 Mechanical hazards

4.2.1 Tumble dryers

4.2.1.1 Rotating cage: entanglement within the rotating cage or between moving and fixed elements.

4.2.1.2 Power-operated doors: crushing and shearing between the tumble dryer doors and frame.

4.2.1.3 Tilting tumble dryers (in addition to the hazards described in 4.2.1.1 and 4.2.1.2):

- crushing and shearing between the dryer and fixed parts, including the structure of the building, and descent by gravity during maintenance;
- ejection of pressurized fluids;
- overturning of tilting machines.

4.2.2 Tunnel finishers: drawing-in or trapping between the screw conveyor and fixed elements.

4.3 Electrical hazards

See ISO 10472-1:1997, 4.2.

4.4 Thermal hazards

4.4.1 Hot surfaces around the loading door: burns.

4.4.2 Loading and unloading areas of the tunnel finisher: burns.

4.4.3 Steam spray in tunnel finisher: scalding.

4.5 Hazards generated by noise

Noise emitted by fan ducting of tumble dryers and tunnel finishers may cause a hazard. See ISO 10472-1:1997, 4.4.

4.6 Hazards associated with materials and substances

4.6.1 Fire and explosion

4.6.1.1 Tumble dryers: fire hazards caused by tumble dryer load, explosion hazards caused by gas-fired equipment and explosion hazards caused by processing of textiles containing flammable vapour.

4.6.1.2 Tunnel finishers and cabinet dryers: fire hazards due to the exothermic effect of incomplete drying of some textiles, leading to spontaneous combustion.

4.6.2 Chemical hazards: aggressive chemicals (e.g. hypochlorite) may cause damage to the machine. Decomposition of chemicals (e. g. of certain dry-cleaning solvents) in direct gas-fired machines may create toxic fumes.

4.7 Failure of control systems

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

5.1 General

The designer shall consider the common safety requirements and/or measures described in ISO 10472-1 in addition to the particular hazards and measures described in this part of ISO 10472.

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5.2 Mechanical hazards

5.2.1 Tumble dryers

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5.2.1.1 Rotating cage

In the case of machines having a net usable cage volume < 1 000 l and a cage stopping time under rated wet load condition < 6 s, interlocking the manually openable door is sufficient (see ISO 14119:—, 5.2.1). For all other machines interlocking with guardlocking is required, e.g. in combination with a time delay (see ISO 14119:—, 5.3).

To prevent spontaneous combustion of the load, in the case of failure of energy supply, the door shall be openable under all circumstances. For dryers with interlocked doors with guard locking, this shall also be possible, e.g. by means of a special tool.

NOTE — National regulations may require that the door be openable from the inside.

For loading or unloading the cage at standstill, no specific measures are required.

For loading or unloading if the cage rotation is initiated manually, reaching into the cage shall be prevented, e. g. by a hold-to-run control at a safe distance or a two-hand control. See ISO 10472-1:1997, 5.1.2.

For loading or unloading if the cage rotation is initiated automatically, incidental access to the danger zone shall be prevented, e. g. by a fixed guard or fence. See ISO 10472-1:1997, 5.1.2 and annex A.

The manufacturer shall state in the instruction handbook the correct procedure for cleaning blockages of work and the safe procedure for entry into the machine as follows:

- shut off the energy supply and lock the shut-off device;
- shut off other energy sources (steam, pressurized air, etc.) and lock the shut-off devices;

- install, if necessary, the means foreseen to prevent a movement by gravity;
- follow the instructions for specific procedures given by the manufacturer (method for clearing blockages and method for entry into the machine).

A warning sign shall be displayed drawing attention to the information given in the instruction handbook.

5.2.1.2 Power-operated doors

The crushing hazard associated with the doors shall be prevented, according to the specific design of the machine, by at least one of the following safety measures (see ISO 10472-1:1997, 5.1.2):

- limitation of closing force to 150 N and the kinetic energy of the moving door to 10 J and of pressure to 0,5 N/mm² until the closing gap is less than 8 mm (see EN 953:1997, 6.2.5); or
- an electrosensitive protective device in accordance with EN 50100-1 to monitor the closing gap; or
- a fixed guard system in accordance with EN 953:1997, 3.2, e.g. for a tumbler with a high entry and discharge position or discharging through a hole in the floor; or
- a pressure sensitive edge on the face of the machine (see EN 1760-2) or a pressure sensitive mat or floor (see EN 1760-1).

5.2.1.3 Tilting tumble dryers

Tilting tumble dryers controlled by the operator shall be actuated by a hold-to-run control device located in a position where the operator can clearly see but cannot reach the danger zone. Alternatively a trip device (e.g. a pressure-sensitive protective device) shall be provided to cease the tilting function if an operator enters the danger zone (see ISO 10472-1:1997, 5.1.2 for the hold-to-run control and trip device).

For automatic tilting tumble dryers, the hazards of crushing, shearing and trapping between fixed and moving elements of the machine or building structure shall be prevented by fixed guards provided by the manufacturer (see ISO 10472-1:1997, 5.1.2). The danger zone created by door opening and cage rotation shall be rendered inaccessible during the period of machine movement and discharge.

This guarding may be a combination of fence guard and electrosensitive protective devices that will permit the placement of trolleys but monitors the danger zone during the danger period.

The design developed for each separate installation may be provided by the user; in this instance, however, the manufacturer shall include detailed design guidance in the instruction handbook.

The machine shall be fitted with means to secure any part that may descend by gravity and create a hazard during maintenance and fault clearing. The hydraulic equipment of tilting tumble dryers shall be in accordance with EN 982, and the pneumatic equipment with EN 983.

Tilting tumble dryers shall be so constructed that overturning is prevented, if possible by designing inbuilt stability, i.e. the basepoint of the centre of gravity shall lie within the polygon of support for all tilting positions.

The manufacturer shall take into account the mass of the maximum load in wet condition, the kinetic energy of tilting parts and the overturning moment created by the opened door. When foundation bolting is one of the measures taken to prevent overturning, the manufacturer shall specify in the instruction handbook the bolts and foundation requirements.

5.2.2 Tunnel finishers

Drawing-in or trapping of the operator's fingers between the screw conveyor and fixed elements shall be prevented by fixed guards (see ISO 10472-1:1997, 5.1.2).