INTERNATIONAL STANDARD

ISO 10472-2

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Safety requirements for industrial laundry machinery —

Part 2:
Washing machines and washer-extractors

Exigences de sécurité pour les machines de blanchisserie industrielle —

Partie 2: Machines à laver et laveuses-essoreuses

Reference number
ISO 10472-2:1997(E)

Contents

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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 10472-2 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*

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.

Safety requirements for industrial laundry machinery —

Part 2:
Washing machines and washer-extractors

1 Scope

This part of ISO 10472 covers, together with ISO 10472-1, most significant hazards associated with washing machines and washer-extractors of all configurations having a net usable cage volume > 60 l.

This part of ISO 10472 does not cover particular hazards for drawer-type washer-extractors.

This part of ISO 10472 does not cover the hazards caused by processing work which may create an explosive or flammable atmosphere inside the machine.

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, e.g. chemical supply pumps, steam valves and supply pipe work, vent systems, work feed systems and discharge systems and ducting to the atmosphere.

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

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

1) To be published.

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.*

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

EN 349:1993, *Safety of machinery — Minimum gaps to avoid crushing of parts of the human body.*

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

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

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

EN 1760-1:1997, *Safety 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 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 following definitions apply.

3.1
washing machine
Machine performing only those operations required for washing textiles.

3.2
washer-extractor
Machine which combines the functions of textile washing and moisture extraction by centrifugal action.

3.2.1
fixed washer-extractor
Washer-extractor in which the drum is rigidly mounted in the frame.

3.2.2
suspended washer-extractor
Washer-extractor in which the drum is not rigidly connected to the frame but is secured by means of a vibration-reducing system.

3.2.3
tilting washer-extractor
Fixed or suspended washer-extractor in which the drum tilts during loading and/or unloading.

[1] To be published.

3.2.4
drawer-type washer-extractor
Fixed or suspended washer-extractor in which two halfcages slide horizontally out from the frame, in the low position for loading and the high position for unloading.

3.2.5
top-loading, vertical axis washer-extractor
Washer-extractor in which the plane of the loading door is at a right angle to the vertical axis of the rotation of the cage.

3.3
front-loading machine
Washing machine or washer-extractor in which the plane of the loading door is at a right angle to the horizontal axis of rotation of the cage.

3.4
side-loading machine
Washing machine or washer-extractor in which the plane of the loading door is parallel to the horizontal axis of rotation of the cage.

3.5
barrier machine
Washing machine or washer-extractor without direct contact between the loading and unloading positions (e.g. separated by a wall).

3.6
aseptic machine
Washing machine or washer-extractor used for processing infected work.

3.7
infected work
Work which has been in contact with persons suffering or suspected of suffering from infectious diseases.

3.8
cage (basket)
Rotating container within which the work is held during the washing process.

NOTE — Generally the cage is fabricated from perforated stainless steel and supported on rigidly or flexibly mounted bearings. The cage can be either undivided (open-pocket machines) or divided into two or more compartments (multi-pocket machines).

3.9
drum
Container within which the cage operates, generally having the access door as an integral component.

3.10
***G*-factor**
Dimensionless quotient of the centrifugal acceleration at the outer cage diameter and the gravitational acceleration, obtained by the formula:

$$G = 5{,}6 \cdot \left[\frac{n}{1000}\right]^2 \cdot d$$

where n is the rotational frequency, in reciprocal minutes;

d is the cage diameter, in centimetres.

4 Hazards

4.1 General

The hazards common to most industrial laundry machinery are listed in ISO 10472-1. Significant particular hazards found in washers and washer-extractors are listed in 4.2 to 4.11.

4.2 Mechanical hazards

4.2.1 **Rotating cage**: crushing, shearing, entanglement, drawing-in and trapping.

4.2.2 **Manual drum doors**: crushing and trapping by falling door.

4.2.3 **Doors (cage and drum)**: drawing-in, trapping, crushing and shearing caused by intended or unintended rotation of the cage during loading or unloading, e.g. while positioning the cage.

4.2.4 **Cage doors**: crushing, shearing, impact due to incorrectly secured cage door leading to ejection of machine parts.

4.2.5 **Power-operated drum doors**: crushing, shearing (closing), impact (opening).

4.2.6 **Loss of stability (due to out-of-balance)**: impact.

4.2.7 **Suspended washer-extractors**: crushing between the suspended drum or attached components and fixed elements of the machine, such as the frame.

4.2.8 **Falling load and loading devices**: impact, crushing.

4.3 Electrical hazards

See ISO 10472-1:1997, 4.2

4.4 Thermal hazards

4.4.1 **Hot liquor**: scalding from spillage and splashing.

4.4.2 **Hot surfaces around the loading and unloading door(s)**: burns.

4.4.3 **Heat energy**: burns and scalding from unintended supply with open door or insufficient water level.

4.4.4 **Viewing panels**: scalding from hot liquor due to broken panels.

4.5 Hazards generated by noise

The extraction cycle may create a noise hazard.

4.6 Hazards associated with materials and substances

4.6.1 **Aggressive chemical action**: harmful malfunction of the machine.

4.6.2 **Fire and explosion**

4.6.2.1 Explosive vapour contained in the load: burns.

4.6.2.2 Gas- and oil-fired heating: burns.

4.6.3 Biological hazards

4.6.3.1 Contact with infected work.

4.6.3.2 Biological or chemical contamination of the public water supply arising from back-flow from the machine.

4.7 Hazards due to neglect of ergonomic principles in machine design

Unhealthy posture due to inadequate height of the loading door of washing machines and of the hopper for adding chemicals; excessive effort when unloading the washer-extractors.

4.8 Hazards caused by failure of energy supply and control systems

Mechanical hazard occurring if the operator reaches the cage during run down or enters the danger zone during tilting (e.g. for maintenance).

4.8.1 Failure of energy supply.

4.8.2 Failure of control systems.

4.9 Hazards caused by unexpected ejection of machine parts

For instance, overspeed of power transmission.

4.10 Particular hazards associated with barrier machines

Entanglement, drawing-in and trapping by the cage or shearing or crushing by the closing power-operated door due to required interaction of two operators, one on each side of a wall.

Contamination, when used as an aseptic machine (see 4.6.3.1).

4.11 Particular hazards associated with tilting machines

4.11.1 **Tilting controlled manually**: crushing and shearing between the tilting machine and fixed elements.

4.11.2 **Automatic tilting (unexpected start-up)**: crushing and shearing between the tilting machine and fixed elements.

4.11.3 **Loading and unloading:** entanglement.

4.11.4 **Overturning**: crushing.

4.11.5 **Maintenance**: drawing-in or trapping.

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 measures described in ISO 10472-1 in addition to the particular hazards and measures described in this part of ISO 10472.

5.2 Mechanical hazards

5.2.1 Rotating cage

The drum doors of horizontal and vertical axis washer-extractors shall prevent access to the rotating cage and shall be interlocked with guard locking (see ISO 10472-1:1997, 5.1.2). This interlock shall be arranged so that door opening is prevented while the cage is rotating. This guard locking device may include, for example, time-delay shut-off to drive-motor, power released spring loaded mechanical brake or motion sensors.

The instruction handbook shall contain details of the testing and maintenance of the braking if used in conjunction with a time-delay.

Hoppers for the manual addition of washing chemicals shall be fitted with means to prevent access to the rotating cage. Such means shall be in accordance with ISO 13852:1996, table 4 (e.g. safety bars at the base of the hopper and a fixed guard in the form of a weir allowing fluid flow but not access).

5.2.2 Manual drum doors

Upward opening doors shall be fitted with a device (e.g. a catch or damping cylinders) to prevent accidental falling back of the door which could generate crushing or trapping hazards. The device shall operate even in case of power failure.

This does not apply to top-loaded vertical axis washer-extractors where the light-weight door (less than 2 kg) opens over the centre.

5.2.3 Doors (cage and drum)

It shall not be possible to position the cage of multi-pocket or of side-loading machines using power when any drum door is open. This requirement does not apply if the machine is automatically loaded or unloaded and access to the danger zone is completely prevented.

For multi-pocket machines where rotation by gravity may create a hazard, measures shall be taken to prevent this rotation while the cage and drum doors are open (e.g. mechanical brake, adequate to support the static out-of-balance load in the maximum load case).

5.2.4 Cage doors

Measures shall be taken to prevent cage doors opening after the drum door has been closed and the machine started.

Such measures may include, for example:

— ensuring adequate machine rigidity to prevent component flexing;

— providing a mechanical trapped-key system that cannot be removed from the cage door until the locking mechanism is correctly engaged.

The instruction handbook shall include detailed advice concerning the inspection and maintenance of the cage door locking means.

5.2.5 Power-operated drum doors

5.2.5.1 Door closing

The hazard due to the automatic closing of doors shall be prevented by one of the following means:

a) where practical, by limitation of force to less than 150 N, and kinetic energy at any door position to less than 10 J and pressure less than 0,5 N/mm², until the gap is less than 8 mm (see EN 953:1997, 6.2.5);

or

b) access prevention by guards (see ISO 10472-1:1997, 5.1.2) such as:

— fences according to ISO 10472-1:1997, annex A;

— casings or covers;

or

c) stopping the door movement by safety devices (see ISO 10472-1:1997, 5.1.2) which are effective only during the closing process of the door, e.g.

— electrosensitive protective devices;

— pressure-sensitive mats or floors (see EN 1760-1);

— trip bars taking into account the stopping time (see EN 1760-2);

or

d) by providing a hold-to-run control (see ISO/TR 12100-1:1992, 3.23.3) for door closing. Such a control shall be located so that the operator has a clear view of the danger zone but cannot reach it.

5.2.5.2 Door opening

If an operator can enter the danger zone and if the maximum velocity of any element of the door on opening is greater than 0,3 m/s, then the instruction handbook shall give information on design and installation of a barrier to prevent impact hazard. The barrier shall not create a new hazard.

As an alternative, the manufacturer may provide a hold-to-run control (see ISO/TR 12100-1:1992, 3.23.3) for door opening. Such a control shall be located so that the operator has a clear view of the danger zone but cannot reach it.

5.2.6 Loss of stability

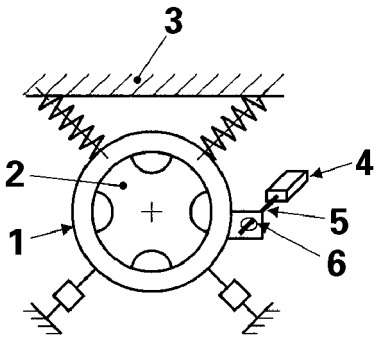
Fixed washer-extractors with a *G*-factor greater than 150 and all suspended washer-extractors shall be fitted with means for detecting an out-of-balance condition of the loaded rotating cage. Such means shall be set to operate at an acceptable limit beyond which the rotational speed shall be reduced (e.g. to washing speed).

Sensing devices shall be fitted so that they cannot be invalidated by unauthorized persons.

The manufacturer shall describe in the instruction handbook the method of testing the out-of-balance control system.

EXAMPLE

A rigid bracket fitted to the drum having an elongated hole into which a sensor switch arm protrudes. The sensor switch is rigidly mounted to the machine frame. Any undue movement of the drum will cause the switch contacts to close and reduce the rotational speed to a safe limit (see figure 1).



Key

1 drum
2 cage
3 frame
4 sensor switch
5 switch arm
6 hole

Figure 1 — Sensing device for out-of-balance condition

5.2.7 Suspended washer-extractors

The minimum distance between the suspended drum and fixed elements shall be as given in EN 349:1993, 4.2 to avoid crushing of the hand. Alternatively, the crushing zone shall be protected by rigid or flexible covers (see ISO 10472-1:1997, 5.1.2).

5.2.8 Falling load and loading devices

In order to avoid hazards due to the unintended release of overhead loads (e.g. loading of tilting washer-extractors from overhead bags or chutes) guards and/or safety devices (see ISO 10472-1:1997, 5.1.2) shall be provided. Where the loading device is provided by the user, the manufacturer shall describe in the instruction handbook the hazards and appropriate additional safety measures. Chutes shall be designed in such a manner that, in the event of loss of power, they will not fall.

5.3 Electrical hazards

For machines having a net usable cage volume ≥ 150 l, the electrical design shall be in accordance with EN 60204-1 as specified in ISO 10472-1:1997, 5.2.

For machines having a net usable cage volume of between 60 l and 150 l, the manufacturer shall decide if IEC 335-1 and IEC 335-2-7 apply or if EN 60204-1 applies (see ISO 10472-1:1997, 5.2).

The manufacturer shall explain his decision in the instruction handbook.

5.4 Thermal hazards

5.4.1 Hot liquor

All machines fitted with self-heating equipment shall have a vent to prevent dangerous build-up of pressure or vacuum, for example, caused by uncontrolled energy supply. In the case of steam-heated machines, the vent shall have a minimum diameter of 2,5 times the diameter of the steam supply duct, but not less than 30 mm. The vent shall discharge in such a way that the exhaust does not endanger people.

All machines shall be fitted with an overflow to prevent overfilling of the machine. This shall be of such dimensions as to discharge the maximum rate of the input flow of water, and positioned to discharge to a safe place.

It shall not be possible to open the drum door with the liquor level above the door sill. This may be achieved, for example, by interlocking the door locking with a level sensor and interlocking the door with the drain valve, see ISO 14119:—, clause 5.

On side loading washing machines, splashing of hot liquor on the loading side shall be limited (e.g. by fitting metal screens).

The opening to add washing chemicals shall be designed to prevent the discharge or splashing of hazardous liquid (e.g. via a non-return valve, or lid interlocked with the machine, or feed hopper overflow connected to a drain).

5.4.2 Hot surfaces

Concerning hot surfaces surrounding the loading or unloading door(s), see ISO 10472-1:1997, 5.3.

Technical measures shall be applied to the door handle but need not be applied to the drum door, nor the viewing panel, nor the area of the machine face adjacent to the door.

5.4.3 Heat energy

The heat energy supply shall be interlocked with the sensor of the water level and shall be interlocked with guard locking with the door, see ISO 14119:—, clause 5.

Application of heat energy shall not be possible while the drum door is open or when there is an insufficient level of water in the machine. The minimum water level shall be stated by the manufacturer in the instruction handbook.

5.4.4 Viewing panels

Viewing panels shall be designed to withstand anticipated conditions of pressure and thermal shock.

The manufacturer shall state in the instruction handbook the maximum steam pressure and injection rate, or the maximum rate of liquor temperature change for which the viewing panel is suitable. The viewing panel shall be designed to sustain the maximum possible liquor level.

5.5 Hazards generated by noise

See ISO 10472-1:1997, 5.4.

5.6 Hazards associated with materials and substances

The manufacturer shall state in the instruction handbook the range of processes for which the machine may or may not be suitable (e.g. treatment of rags containing volatile solvents) (see ISO 10472-1:1997, 7.1).

5.6.1 Aggressive chemical action

The machine shall be constructed from materials suitable for the intended process (e.g. stone washing, chemical dyeing).
In the instruction handbook, attention shall be drawn to the fact that the use of hypochlorite will cause corrosion which may cause component failure under certain circumstances.

5.6.2 Fire and explosion

5.6.2.1 Explosive atmosphere

This part of ISO 10472 does not give technical advice about protection against explosions.

The manufacturer shall state in the instruction handbook that washing machines and washer-extractors not specifically designed for work which may create an explosive atmosphere (inside the machine) shall not be used for this purpose.

5.6.2.2 Gas- and oil-fired heating

The safety requirements and/or measures of ISO 10472-1:1997, 5.5.2 shall apply.

For machines with a net usable cage volume < 150 l, see the note in 5.5.2 of ISO 10472-1:1997.

5.6.3 Biological hazards

5.6.3.1 Contact with infected work

Aseptic machines shall be fitted with interlocked control to ensure a disinfection cycle is operated, see ISO 14119:—, clause 5. The controls shall be arranged so that the drum door (unloading door in the case of a barrier machine) cannot be opened until the disinfection cycle is completed (see ISO 10472-1:1997, 5.5.4).

The manufacturer shall give advice in the instruction handbook concerning the requirements for the user to test for disinfection effectiveness.

NOTE — National regulations may exist for the disinfection cycle.

5.6.3.2 Biological or chemical contamination of the water supply

The manufacturer shall provide means to prevent back syphonage of contaminated water to the main water supply and shall draw the user's attention, by a note in the instruction handbook, to local or national regulations for water supply.

5.7 Hazards due to neglect of ergonomic principles in machine design

See ISO 10472-1:1997, 5.6 for guidance when designing the height of the loading or unloading door and of the hopper for adding chemicals.

NOTE — If the risk assessment indicates that excessive effort would be required to unload a machine the manufacturer should provide means to assist this operation (e.g. portable unloading device), and give advice on their use in the instruction handbook.

5.8 Failure of energy supply and control systems

5.8.1 Failure of energy supply

See ISO 10472-1:1997, 5.7.1.

Means shall be supplied with the machine to prevent uncontrolled fallback from tilting (e.g. timber props for maintenance operation). The instruction handbook shall contain instructions on their use.

5.8.2 Failure of control systems

The category of the safety-related part of the control system (see ISO 13849-1:—, clause 6) shall be not lower than category 1 except for the tilting control system which shall be not lower than category 2. This shall provide for automatic test on start-up.

5.9 Hazards caused by unexpected ejection of machine parts

For washer-extractors with two or more motors, all transmission components shall be capable of operating at the highest speed of which the machine is capable. Otherwise, means shall be provided to prevent any low speed component operating at an excessive speed. For example, for washer-extractors with two or more motors and a clutch, these can be fitted with an overspeed sensitive device to detect transmission overspeed and stop the machines in this event (e.g. pulse generator or centrifugal switch).

5.10 Particular hazards associated with barrier machines

It shall not be possible to open the drum doors on the loading and unloading sides simultaneously. In addition, the following shall apply:

— the two doors shall be interlocked in such a way that the machine can run only if both doors are closed, see ISO 14119:—, clause 5; and

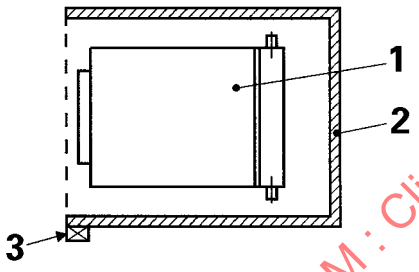
— the machine shall be fitted with signalling devices providing reciprocal information to both sides of the machine; and

— the controls for drum doors shall be positioned on the same side of the barrier as the corresponding door.

5.11 Particular hazards associated with tilting machines

5.11.1 Tilting controlled manually

These machines shall be guarded except in positions where access is required for loading and unloading. In these positions, safety devices shall be provided, for example, the tilting of the machine may be controlled by a hold-to-run control device located in a position where the operator can clearly see but cannot reach any crushing and shearing zones which are not protected (see figure 2).



Key

1 tilting machine
2 guard
3 hold-to-run control

Figure 2 — Safeguarding of tilting machines controlled manually

5.11.2 Automatic tilting

For individual machines crushing and shearing points between fixed and tilting elements of the machine shall be guarded (see ISO 10472-1:1997, 5.1.2). The manufacturer shall inform the user in the instruction handbook about the hazard of crushing and shearing between the tilting elements and other machines or structures of the building.

For fully automatic installations, the danger zone shall be rendered inaccessible by interlocking guards.

5.11.3 Loading and unloading

For power-operated drum doors, see 5.2.5.

For automatic tilting machines with power-driven rotation which have to be loaded or unloaded while the cage rotates, the hazard caused by the rotating cage shall be excluded by guards and/or safety devices (e.g. fences, pressure-sensitive mats or floors or electrosensitive protective devices, see ISO 10472-1:1997, 5.1.2).

For manually controlled tilting machines the manufacturer shall provide means to exclude the hazard of entanglement by a hold-to-run control for rotation of the cage during loading and unloading.

5.11.4 Overturning

Tilting washer-extractors shall be so constructed that overturning of the machine 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, including undrained water, the kinetic energy of the tilting part 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.

5.11.5 Maintenance

The machine shall be fitted with means for securing any part that may descend by gravity and create a hazard during maintenance or fault clearing.

6 Verification of safety requirements and/or measures

Verification shall follow the general requirements of ISO 10472-1 and the particular requirements of clause 5 of this part of ISO 10472. Table 1 gives a list of verifications.

Table 1 — List of verifications

Sub-clause	Subject	Reference	Test method
5.2.1	Rotating cage		
	Interlocking guard with guard locking for door	ISO 10472-1:1997, 5.1.2	Physical test NOTE — This test shall not be carried out when the liquor level is above the door sill.
	Braking in conjunction with time delay	Instruction handbook	Follow test in instruction handbook and instruction for maintenance
	Guards or bars inside hoppers	ISO 13852	Visual inspection, Measurement
5.2.2	Drum doors		
	Support for drum door to prevent falling		Function test Visual inspection
5.2.3	Doors (cage and drum)		
	Positioning the cage by power	EN 1037	Function test
	Interlocking the drum door	ISO 14119	Open drum door and attempt to move cage by power
	Rotation by gravity		Switch off power, open drum and cage door and attempt to move cage by hand
5.2.4	Cage doors		
	Means to prevent opening after closing of the drum door		Function test
	Maintenance	Instruction handbook	Confirm accuracy and content

Table 1 *(continued)*

Sub-clause	Subject	Reference	Test method
5.2.5.1	Automatic closing		
a)	Limitation of force	EN 953	Measurement
b)	Guards	ISO 10472-1:1997, 5.1.2	
	- fence guard	ISO 13852 ISO 13853	Measurement Measurement
c)	Trip devices	ISO 10472-1:1997, 5.1.2 EN 1760-1 EN 1760-2	 Demonstration Demonstration
d)	Hold-to-run control	ISO/TR 12100-1	Demonstration
5.2.5.2	Door opening		
	Barrier	Instruction handbook	Measurement Confirm accuracy and content
	Hold-to-run-control	ISO/TR 12100-1	Demonstration
5.2.6	Loss of stability		
	G-factor		Calculation
	Device for detecting out-of-balance	Manufacturer's technical file	Calculation of maximum values and demonstration
	Invalidation by unauthorized person		Check that the device cannot be invalidated
	Method of test	Instruction handbook	Confirm accuracy and content
5.2.7	Suspended washer-extractors		
	Gap between drum and fixed parts	EN 349	Measurement
	Covers to protect the gap	ISO 10472-1:1997, 5.1.2	Check presence and function

Table 1 *(continued)*

Sub-clause	Subject	Reference	Test method
5.2.8	Falling load and loading devices		
	Falling load	ISO 10472-1:1997, 5.1.2	Visual inspection and/or function test
		Instruction handbook	Confirm accuracy and content
	Falling chute		Function test
5.3	Electrical hazards		
	Machine capacity > 150 l	EN 60204-1:1992, clause 20 ISO 10472-1:1997, 5.1.2	
	Machine capacity between 60 l and 150 l	IEC 335-1 IEC 335-2-7	
	Decision of the manufacturer	Instruction handbook	Confirm accuracy and content
5.4.1	Hot liquor		
	Vent		Measure dimensions Inspect position
	Overflow		Close the drain valve and fill the machine with liquor at the maximum rate predicted by the manufacturer. Check that the overflow operates adequately.
	Interlocking of door, level sensor, drain valve	ISO 14119	Fill with cold water, attempt to open the drum door and check position of drain valve.
	Means to limit splashing		Check presence and efficacy
	Means to prevent discharge of hazardous liquid		Check presence and efficacy
5.4.2	Hot surfaces	ISO 10472-1:1997, 5.3	Measure surface temperature after one or more washing cycles at the highest process temperature