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Safety requirements for dry-cleaning machines —

Part 1: Common safety requirements

Exigences de sécurité pour les machines de nettoyage à sec —

Partie 1: Exigences générales de sécurité

Reference number
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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 8230-1 was prepared by Technical Committee ISO/TC 72, *Textile machinery and accessories*, Subcommittee SC 5, *Industrial laundry and dry-cleaning machinery and accessories*.

This first edition of ISO 8230-1, together with ISO 8230-2:2008 and ISO 8230-3:2008, cancels and replaces ISO 8230:1997, of which it constitutes a technical revision.

ISO 8230 consists of the following parts, under the general title *Safety requirements for dry-cleaning machines*:

— *Part 1: Common safety requirements*

— *Part 2: Machines using perchloroethylene*

— *Part 3: Machines using combustible solvents*

Introduction

This document is a type-C standard as stated in ISO 12100.

The machinery concerned and the extent to which hazards, hazardous situations or hazardous events are covered are indicated in the Scope of this document.

When requirements of this type-C standard are different from those which are stated in type-A or -B standards, the requirements of this type-C standard take precedence over the requirements of the other standards for machines that have been designed and built according to the requirements of this type-C standard.

Safety requirements for dry-cleaning machines —

Part 1:
Common safety requirements

1 Scope

This part of ISO 8230 specifies common safety requirements for dry-cleaning machines.

It is applicable to dry-cleaning machines of all sizes intended for industrial and commercial use for the cleaning of articles made of textile, leather, furs and skins, using exclusively either perchloroethylene or combustible solvent as the cleaning medium.

It is not applicable to:

— machines placed at the disposal of the general public (self-service);

— barrier machines as defined in 3.1.5;

— transfer machines as defined in 3.1.4;

— ironing presses (see ISO 10472-1 and ISO 10472-6);

— ancillary equipment, e.g. room ventilation equipment, waste recuperation systems of the still, external water cooling systems or external systems for solvent recovery from the still sludge.

This part of ISO 8230 deals with all significant hazards arising from the use of the dry-cleaning machine, where “use of the dry-cleaning machine” comprises both intended use and foreseeable abnormal situations and includes commissioning, use and maintenance. It defines the common safety requirements for dry-cleaning machines and is intended to be used in conjunction with ISO 8230-2 and ISO 8230-3, as relevant. Specific requirements in those other parts of ISO 8230 take precedence over the respective requirements of this part of ISO 8230.

It does not deal with hazards caused by processing items that can create an explosive atmosphere (e.g. printers' wipers containing a low-flash solvent), nor with machines processing loads that can contain “foreign solvents”, which could lead to a change in a property (characteristic) of the cleaning solvent, e.g. cause foaming or make it carcinogenic.

This part of ISO 8230 applies to machines manufactured after the date of its issue.

2 Normative references

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

IEC 60204-1:2005, *Safety of machinery — Electrical equipment of machines — Part 1: General requirements*

IEC 61496-1:2004, *Safety of machinery — Electro-sensitive protective equipment — Part 1: General requirements and tests*

ISO 3744:1994 [1)], *Acoustics — Determination of sound power levels of noise sources using sound pressure — Engineering method in an essentially free field over a reflecting plane*

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

ISO 5232:1998, *Graphical symbols for textile machinery*

ISO 6178:1983, *Centrifuges — Construction and safety rules — Method for the calculation of the tangential stress in the shell of a cylindrical centrifuge rotor*

ISO 8230-2, *Safety requirements for dry-cleaning machines — Part 2: Machines using perchloroethylene*

ISO 8230-3, *Safety requirements for dry-cleaning machines — Part 3: Machines using combustible solvents*

ISO 8232:1988, *Closed-circuit dry-cleaning machines — Defining and checking of machine characteristics*

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

ISO/TR 11688-1:1995, *Acoustics — Recommended practice for the design of low-noise machinery and equipment — Part 1: Planning*

ISO/TR 11688-2:1998, *Acoustics — Recommended practice for the design of low-noise machinery and equipment — Part 2: Introduction to the physics of low-noise design*

ISO 12100-1:2003, *Safety of machinery — Basic concepts, general principles for design — Part 1: Basic terminology, methodology*

ISO 12100-2:2003, *Safety of machinery — Basic concepts, general principles for design — Part 2: Technical principles*

ISO 13732-1, *Ergonomics of the thermal environment — Methods for the assessment of human responses to contact with surfaces — Part 1: Hot surfaces*

ISO 13732-3:2005, *Ergonomics of the thermal environment — Methods for the assessment of human responses to contact with surfaces — Part 3: Cold surfaces*

ISO 13849-1:2006, *Safety of machinery — Safety-related parts of control systems — Part 1: General principles for design*

ISO 13850:2006, *Safety of machinery — Emergency stop — Principles for design*

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

ISO 13855:2002, *Safety of machinery — Positioning of protective equipment with respect to the approach speeds of parts of the human body*

ISO 13856-1:2001, *Safety of machinery — Pressure-sensitive protective devices — Part 1: General principles for design and testing of pressure-sensitive mats and pressure-sensitive floors*

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1) Under revision.

ISO 14119:1998, *Safety of machinery — Interlocking devices associated with guards — Principles for design and selection*

ISO 14120:2002, *Safety of machinery — Guards — General requirements for the design and construction of fixed and movable guards*

ISO 14122-1:2001, *Safety of machinery — Permanent means of access to machinery — Part 1: Choice of fixed means of access between two levels*

ISO 14122-2:2001, *Safety of machinery — Permanent means of access to machinery — Part 2: Working platforms and walkways*

ISO 14122-3:2001, *Safety of machinery — Permanent means of access to machinery — Part 3: Stairs, stepladders and guard-rails*

EN 378-1:2000, *Refrigerating systems and heat pumps — Safety and environmental requirements — Part 1: Basic requirements, definitions, classification and selection criteria*

EN 378-2:2000, *Refrigerating systems and heat pumps — Safety and environmental requirements — Part 2: Design, construction, testing, marking and documentation*

EN 614-1:2006, *Safety of machinery — Ergonomic design principles — Part 1: Terminology and general principles*

EN 981:1996, *Safety of machinery — System of auditory and visual danger and information signals*

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

EN 61310-1:1995, *Safety of machinery — Indication, marking and actuation — Part 1: Requirements for visual, auditory and tactile signals*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 12100-1 and the following apply.

3.1 Machine configuration

3.1.1
dry-cleaning machine
equipment in which articles made of textile, leather, fur or skin are cleaned, treated and dried

NOTE Equipment such as solvent recovery, inerting and distilling equipment can also be part of the dry-cleaning machine.

3.1.2
closed-circuit dry-cleaning machine
dry-cleaning machine in accordance with ISO 8232, in which reduction is carried out without any contact between the air in the drum and the air in the workroom

3.1.3
open-circuit dry-cleaning machine
dry-cleaning machine, in which the deodorization takes place by an intake of fresh air and evacuation of any solvent/air mixture out of the dry-cleaning machine, prior to the opening of the loading/unloading door

3.1.4
transfer machine
equipment where cleaning machine and tumbler are separated and where the load has to be transferred after extraction from the cleaning machine to the tumbler

3.1.5
barrier dry-cleaning machine
dry-cleaning machine designed in such a way that, for hygienic reasons, contact between clean articles and dirty articles is avoided by a partition

NOTE This is the case in particular with machines having two doors in which loading and unloading are carried out on opposite sides of the partition.

3.2 Machine components

3.2.1
drum
enclosure or container in which the cage rotates

3.2.2
cage
rotating perforated cylinder, enclosed by the drum, in which the load to be cleaned is placed

NOTE The capacity of the cage is defined in ISO 8232.

3.2.3
loading door
device for locking the cage and/or drum apertures for loading and unloading

3.2.4
tank
container used to store the solvent for the cleaning process

3.2.5
solvent filter
device for removing undissolved particles mechanically and/or dissolved particles by adsorption, from liquid solvent

3.2.6
button trap filter
device to protect the solvent pumps from solid objects during the cleaning phase

3.2.7
drying system
all parts comprising the circuit through which a current of air flows, in which the air flow is heated and cooled in fixed sequences in order to recover the solvent contained in the articles after the cleaning phase

3.2.8
drying condenser
device for cooling the air flow and condensing solvent vapour and water vapour

3.2.9
lint filter
device for removing lint and particles mechanically from the air during the drying phase

3.2.10
distilling equipment
all parts for regenerating solvent by vaporization and condensation, i.e. to separate dirt, chemicals (e.g. soap) and water

3.2.11
still
device of the distilling equipment for heating the dirty solvent and evaporating solvent and water, leaving in the still the dirt and chemicals (e.g. soap)

3.2.12
still condenser
device of the distilling equipment which condenses and cools solvent vapour and water vapour

3.2.13
water separator
device of the dry-cleaning machine and/or the distilling equipment which separates by gravity the solvent/water mixture coming from drying condensers

3.2.14
inspection device
any device used for extraordinary maintenance or inspection of the dry-cleaning machine

3.2.15
safety spillage tray
container placed below the dry-cleaning machine used to collect the solvent in case of spillage

3.2.16
refrigeration system
equipment that can be part of the drying system, used to cool down and heat the air flow by means of a refrigerant in order to recover the solvent

NOTE It can also be used for solvent cooling or condensing solvent vapour and water vapour from the still.

3.3 Operating phases

3.3.1
working cycle
procedure consisting of a cleaning, a drying and a reduction or a deodorization phase by processing of the load from the start until unloading

3.3.2
cleaning phase
procedure for removing dirt from the articles to be treated by means of solvent baths and mechanical action, including filtering of liquid solvent and final extraction of the solvent from the articles

3.3.3
drying phase
procedure for removing and recovering the solvent contained in the articles after the cleaning phase

3.3.4
deodorization
removal of air contaminated with solvent vapour from the dry-cleaning machine, after the drying phase but before unloading to eliminate solvent odour by an intake of fresh air into the drum

3.3.5
reduction
reduction of solvent concentration in the articles and in the air within the dry-cleaning machine after the drying phase, exclusively within the closed circuit, and without any contact between the air in the drum and the air outside of the dry-cleaning machine

3.4 Miscellaneous

3.4.1
g-factor
G
dimensionless quotient of the centrifugal acceleration at the outer cage diameter and the gravitational acceleration

NOTE It is obtained by the formula:

$$G = 5,6 \cdot \left[\frac{n}{1\ 000} \right]^2 \cdot d$$

where

n is the rotational frequency, in reciprocal minutes;

d is the cage diameter, in centimetres.

3.4.2
solvent total charge
maximum permissible content of the tanks and filling capacity of filters as shown in the dry-cleaning machine manual

3.4.3
contact water
water recovered from the dry-cleaning machine process and that contains traces of solvent

3.4.4
maximum dry load
volume of load marked on the loading door, or the weight of the load indicated on the dry-cleaning machine plate, whichever is the lesser

3.4.5
static weight
sum of the weight of the dry-cleaning machine, the solvent total charge and the maximum dry load of the dry-cleaning machine, expressed in newtons

3.4.6
dynamic force
force generated by the unbalanced load

NOTE 1 It is calculated as follows:

$$F = k \cdot m \cdot r \cdot \omega^2$$

where

F is the force, in N;

k is the dimensionless factor;

m is the maximum dry load, in kg;

r is the cage radius, in m;

ω is the angular velocity of the cage, in rad/s.

NOTE 2 The k-factor may range from 0,1 to 0,6 because it may depend on several factors, such as: machine structure (hard-mounted machines will have a high k-factor, whereas soft-mounted or machines with a balancing system will have a low k-factor); density of solvent (the lower the density, the lower the k-factor); motor control (with a frequency converter, the k-factor can be lower than without one).

3.4.7
total weight of the dry-cleaning machine
sum of the static weight and dynamic force

3.4.8
total specific weight of the dry-cleaning machine
value obtained when the total weight is divided by the supporting surface (length × width of the dry-cleaning machine base)

3.4.9
perchloroethylene
perc
chlorinated solvent, chemical name tetrachloroethylene, chemical formula C_2Cl_4

3.4.10
combustible solvent
CS
solvent with a flash point higher than 55 °C, thermally stable under the conditions of intended use

NOTE National regulations may define the maximum content of chemical compounds used in each type of solvent, within the scope of environmental and health and safety regulations.

4 Safety requirements and/or protective measures

Dry-cleaning machines shall comply with the safety requirements and/or protective measures of this clause, in as far as these are not modified or completed by the requirements of ISO 8230-2 and ISO 8230-3, as relevant.

In addition, they shall be designed according to the principles of ISO 12100-2 for relevant but not significant hazards which are not dealt with by this document.

For hazards that are to be reduced by the application of type-B standards such as IEC 60204-1:2005, ISO 13732-3:2005, ISO 13849-1:2006, ISO 13850:2006, ISO 13852:1996, ISO 13853:1998, ISO 13855:2002, ISO 13856-1:2001, ISO 14118:2000, ISO 14119:1998, ISO 14120:2002, EN 563:1994, EN 983:1996, IEC 61496-1:2004, EN 614-1:2006, the manufacturer shall carry out a risk assessment to decide on the correct options.

Where, for the sake of clarity of a requirement, an example of a safety measure is given in the text, this should not be considered as the only possible solution. Any other solution is permissible, but the manufacturer should establish that an equivalent level of safety is achieved in as far as it fulfils the criteria of the requirement.

4.1 Mechanical hazards

4.1.1 Moving transmission parts

Access to dangerous moving transmission parts (main drive, spin filters drive, etc.) shall be prevented by fixed or moveable guards.

Fixed guards shall be as defined in ISO 14120:2002, 3.2, and shall be used only if no frequent access is required. Their fixing elements shall remain attached to the guards or to the machinery when the guards are removed.

Moveable guards shall be interlocking in accordance with ISO 14119:1998, 3.2. The related parts of the control system shall present at least a performance level of PL = c in accordance with ISO 13849-1:2006.

Safety distances and openings of guards shall comply with ISO 13852:1996, Table 1, and/or ISO 13852:1996, Table 4.

4.1.2 Rotating cage

Access to the rotating cage shall be prevented by designing the access door(s) as movable interlocking guard(s) with guard locking in accordance with ISO 14119:1998, 3.3, e.g. in combination with a motion sensor or time delay, so that it is not possible to open the door until motion has stopped.

The control system for this function shall present at least a performance level of PL = c in accordance with ISO 13849-1:2006.

4.1.3 Ejection of machine parts

Means of preventing hazards resulting from the rupture of components and/or projection of fragments under the effect of rapid rotation shall be integrated into the dry-cleaning machine design as follows:

— the assembly, particularly shafts and bearings, shall be capable of withstanding the maximum force to which it can be subjected in use under the conditions stated by the manufacturer in the instruction handbook and shall take into account the foreseeable effects of fatigue, corrosion and ageing;

— for dry-cleaning machines having a g-factor of $G > 100$, the tangential stress on the shell of the cage shall be calculated in accordance with ISO 6178:1983.

4.1.4 Loading doors

4.1.4.1 Crushing, shearing or impact

Manual loading doors shall be able to be opened and closed by actuating a handle. Powered loading doors shall be able to be opened and closed by means of a device remotely controlled from a panel situated outside the danger zone of the doors and from which the operator can clearly see the operation.

4.1.4.2 Automatic operation of doors without the operator's command

A trip device, e.g. a pressure-sensitive mat or floor or an electro-sensitive safety device, shall be installed for detecting the penetration or presence of a person in the danger zone in order to prevent or arrest the movement of the door.

Pressure-sensitive mats or floors shall comply with the minimum requirements of ISO 13856-1:2001, 4.15, and shall be positioned in accordance with ISO 13855: 2002, Clause 7.

Electro-sensitive safety devices shall at least comply with the requirements for IEC 61496-1:2004, type 2, and shall be positioned in accordance with ISO 13855:2002, Clause 6.

4.2 Thermal hazards

4.2.1 Hot surfaces

The temperature of handles shall comply with ISO 13732-1:2006, 4.2.2, for a contact period of 10 s.

The temperature of touchable walls and of parts not intended to be handled during use shall conform to ISO 13732-1:2006, 4.2.1, for a contact period of 1 s, or these walls and parts shall be insulated or guarded for bringing the temperatures within these limits.

Where it is technically not possible to respect these limits, appropriate safety signs shall warn of the hazards and corresponding instructions shall be given in the instruction handbook (see Clause 6).

4.2.2 Steam heating

Steam-heated machines shall have a readily accessible and permanently operational shut-off valve. This valve shall be lockable in the closed position. If this valve has to be installed at the place of use, appropriate instructions shall be given in the instruction handbook. Steam pipes shall be insulated in accordance with 4.2.1.

4.2.3 Systems using thermal fluid at atmospheric pressure

In order to avoid an excessive fluid temperature, this shall be controlled by a thermostatic heating regulator acting directly on the power control of the heater, completed by a second thermostat protected against manipulation or accidental change of the settings. The maximum limit of the adjustment range of the thermostats shall ensure that the operating temperature of the thermal fluid remains below the maximum temperature recommended by the thermal fluid manufacturer.

The temperature of the thermal fluid shall be sensed independently so as to monitor the correct running of the thermostat, and an alarm shall be given if, due to thermostat fault, the temperature reaches a defined limit. The instruction handbook shall contain information on appropriate actions.

An expansion vessel or an expansion volume shall be fitted on the heating chamber or else the heating chamber shall be large enough to accommodate the increase in the volume of thermal fluid without overflow, associated with the maximum temperature setting of the thermostat. The vessel shall permit the level of thermal fluid at the regulator temperature to be checked, e.g. by direct reading.

The flow of thermal fluid to the dry-cleaning machine shall be interrupted while the dry-cleaning machine is at standstill, e.g. by using automatic valves of the normally closed type.

Advice shall be given in the instruction handbook for periodic cleaning of the venting pipe, e.g. once per year, to avoid an blockage.

4.2.4 Systems using pressurized fluids

Components made of a fragile material (e.g. glass) and containing pressurized fluids at temperatures of more than 50 °C (e.g. steam, water or oil) shall be designed so as to prevent direct spraying in the event of leakage or rupture, or shall be shielded to protect people against harm.

4.2.5 Cold surfaces

The temperature of handles shall comply with ISO 13732-3:2005, 5.3.

The temperature of touchable walls and of parts not intended to be handled during use shall conform to ISO 13732-3:2005, 5.2, or these walls and parts shall be insulated or guarded for bringing the temperatures within these limits.

Where it is technically not possible to respect these limits, appropriate safety signs shall warn of the hazards and corresponding instructions shall be given in the instruction handbook (see Clause 6).

4.3 Noise hazards

4.3.1 Noise reduction at source by design

All available information and technical arrangements shall be taken into account in order to limit the noise of machine parts, pneumatic equipment, steam equipment and accessories at the sound source, from the design stage of the dry-cleaning machine. See ISO/TR 11688-1 and ISO/TR 11688-2.

The major sound sources are:

— mechanical transmission components (motors, gears, belts, etc.);

— flowing medium, such as drying air, steam for heating, discharging air of the pneumatic system;

— pumps for solvent, vacuum, etc.

Examples of noise reduction measures are:

a) static and dynamic balancing of the cage and other rotating parts;

b) vibration damped mounting of the dry-cleaning machine or the drum;

c) reduction of impactive over-clearance of rotational bearings by application of positive pre-loading;

d) proper choice and design of the drying fan;

e) proper choice and design of the drive of the drum (motor, gear, belts, bearings, etc.);

f) proper design of the air ducts of the drying system, taking into account vibration damping and avoidance of structural resonance.

4.3.2 Noise reduction by protective measures

Examples of protection against noise are:

a) noise enclosures (e.g. for the cooling compressor or the air ducts);

b) application of mufflers at pneumatic discharges.

4.3.3 Noise control by information

Appropriate information shall be given on the measures that can be applied by the user for reducing noise-related hazards (see 6.3).

4.4 Vibration hazards

The prevention of the effects of vibration shall be provided by design (adequate strength of the various parts of the dry-cleaning machine and floor anchorages) according to the probability of maximum unbalanced mass, created by the nominal load of articles when unevenly distributed. This also applies to machines equipped with an automatic balancing system.

NOTE The force, F, from unbalanced mass to be presumed for floor strain and dimensioning of anchorage can be estimated by means of the formula given in 3.4.6.

4.5 Hazards due to neglect of ergonomic principles in machine design

The design of the dry-cleaning machine shall take into account the ergonomics principles set out in ISO 12100-2:2003, 4.8, and EN 614-1.

4.6 Hazards related to emergency stop and lack of cooling

At least one emergency stop device shall be provided at the main control position. The emergency stop system shall comply with the requirements of ISO 13850. The emergency stop shall cause all machine functions to cease except the provision of cooling medium. The emergency stop system shall have a stop category of 0 or 1 in accordance with ISO 13850:2006 and the related part of the control system shall present at least a performance level of PL = c in accordance with ISO 13849-1:2006. The main electrical switch may be used for the emergency stop function in as far as this does not compromise the provision of the cooling medium. In this case, the colours for identifying the switch shall comply with IEC 60204-1:2005, 10.7.4.

4.7 Hazards related to energy supply disconnection

Readily accessible and permanently operational provisions shall be made for disconnecting the dry-cleaning machine from all of its energy supplies. The disconnecting device(s) shall be lockable. The use of one or more of the devices shall not lead to an unsafe condition.

Electrical devices shall comply with IEC 60204-1:2005, 5.3, while pneumatic devices shall comply with EN 983.

If some of these devices have to be installed at the place of use, appropriate instructions shall be given in the instruction handbook.

4.8 Hazards related to failure of the power supply, other supplies, control system

In the event of failure of one or more services (steam, electric power, compressed air, coolant or inerting medium), the dry-cleaning machine shall go automatically to a safe condition, as follows:

— the loading doors shall remain locked in the closed position;

— it shall be possible to open the doors by means of a tool;

— all valves presenting a risk of solvent leakage outside the dry-cleaning machine shall automatically return to the safe (closed) position;

— in case of any abnormal stop during the working cycle, restart shall only be possible by an intentional action of the operator;

— the presence of the cooling medium shall be monitored so that if cooling water flow is not maintained the dry-cleaning machine will automatically shut down (see 4.10.11 and the relevant clauses of ISO 8230-2 and ISO 8230-3).

All related parts of the control system shall present at least a performance level of PL = c in accordance with ISO 13849-1:2006. Auditory and visual danger and information signals shall comply with EN 981. The pneumatic system shall conform to EN 983.

4.9 Electrical hazards

The safety requirements of IEC 60204-1:2005 shall apply, as described in Table 1.

Table 1 — Safety requirements and/or measures for electrical equipment of dry-cleaning machines

Hazard/Safety requirement and/or measure	Clause(s)/subclause(s) of IEC 60204-1:2005
Electric shock	5, 6, 7, 8, 14, 15 and 17
Overcurrent, overspeed and overload	7 ,8 and 9
Environmental influences	4, 11 and 14
Restart after voltage drop or supply interruption	7.5
Accessibility, layout and identification of control equipment	10, 11 and 16
Ergonomics for manual operation	10 and 11
Cabling and wiring	12 and 13
Accessories and lighting	15
Documentation and instruction handbook	17
Testing of the electrical equipment	18
Degree of protection	11.3, 14

The dry-cleaning machine shall have sufficient immunity to electromagnetic disturbances to enable it to operate safely as intended and not fail to danger when exposed to the levels and types of disturbances intended by the manufacturer.

The manufacturer of the dry-cleaning machine shall design, install and wire the equipment and sub-assemblies taking into account the recommendations of the suppliers of these sub-assemblies.

4.10 Hazards generated by solvents

4.10.1 General

The means described in this clause are aimed at minimizing inhalation of solvent vapour by dry-cleaning machine operator(s), other personnel and members of the public on the premises.

4.10.2 Opening of the loading door

Interlocking with guard locking shall be provided for ensuring that opening of the door is not possible once the solvent has entered the drum and until the drying and deodorization/reduction phases have been completed, see 4.10.3 and ISO 14119.

The control system for this function shall present at least a performance level of PL = c in accordance with ISO 13849-1:2006.

4.10.3 Evaporation of solvent from load that has not been dried sufficiently

A deodorization/reduction phase shall follow only when the drying phase is completed. It shall not be possible to withdraw the load from the dry-cleaning machine until the drying and deodorization/reduction phases have been completed. Means shall be provided for controlling the degree of drying of the load (e.g. by controlling the flow rate of the recuperated solvent, by controlling the time allowed for subsequent completion of drying, by controlling the duration, by controlling temperature or solvent concentration in the cage).

For the case where the drying and deodorization/reduction phases have not been completed properly due to a faulty condition (e.g. service failure, overload of drum, pump failure), advice shall be given in the instruction handbook on

— how to open the door with a tool (by trained maintenance personnel only),

— how to remove the load from the cage in a manner safe for the operator and other personnel, as well as for members of the public who happen to be on the premises, and

— how to return to the regular cycle operation after fixing the fault.

The maximum dry load of the cage shall be marked with a label on the loading door to alert the operator to the risk of inadequate drying of load, if the dry-cleaning machine is overloaded. The wording of this label shall be reproduced in the instruction handbook.

4.10.4 Solvent emission from rotating joints, door hatch seals and flexible tubes

All materials used in rotating joints, door hatch seals and flexible tubes that could come into contact with solvent liquid or solvent vapour shall be resistant to solvent.

Components that provide a resilient seal shall be capable of maintaining their resilience over the recommended maintenance intervals.

Components, including flexible tubes, shall be strong enough to withstand the mechanical forces encountered in use, shall resist failure from fatigue or abrasive wear over recommended maintenance intervals and shall be resistant to solvent.

4.10.5 Solvent emission during cleaning of the lint filter

A label placed next to the access door of the lint filter shall state that the filter has to be cleaned in accordance with the manufacturer's instructions as stated in the instruction handbook. The wording of the label shall be reproduced in the instruction handbook.

An interlocking device in accordance with ISO 14119:1998, Clause 5, shall prevent the operation of the dry-cleaning machine if the door of the lint filter is open or incorrectly closed. The related part of the control system shall present at least a performance level of PL = c in accordance with ISO 13849-1:2006**.**

4.10.6 Solvent emission during cleaning of the button trap

The provisions of 4.10.5 shall also apply to the button trap. The housing of the button trap shall be designed so as to prevent overflow of solvent in the event of accidental opening during operation.

4.10.7 Solvent emission during operation, cleaning and maintenance of the solvent filter

The opening of solvent filters shall only be possible by means of a tool. The opening device (e.g. a screw with sufficient thread length) shall work sufficiently slowly for any inadequate drainage of the filter to be detected. Solvent filters shall be positioned so as to avoid spillage or overflow of solvent when the housings are opened — e.g. vertical, with top opening, or horizontal, with front opening — and have a trough fixed so as to drain the solvent back into the dry-cleaning machine.

The outlet of the vents permitting filling of the filters shall open into the interior of the dry-cleaning machine and not into the atmosphere of the work room.

A pressure gauge shall be fitted on the high-pressure side of the filter. Seals shall be able to withstand the highest pressure that the solvent pumps can generate.

The instruction handbook shall describe the cleaning and maintenance procedure of the solvent filter.

NOTE National regulations requiring or forbidding the use of certain types of filters may exist.

4.10.8 Solvent emission resulting from operation, cleaning and maintenance of distilling installation

4.10.8.1 The still chamber, the still chimney and the still condenser shall be large enough to avoid blockage by solids and shall be readily accessible for cleaning. The still chimney shall have a minimum inside diameter taken from Table 2.

Table 2 — Minimum inside diameter of still chimney

Max. still throughput l/min	**Min. inside diameter of still chimney** mm
⩽ 3,9	42
4,5	45
6,3	53
10,6	69
14,3	80

The safety provisions for pressure vessels shall be observed.

4.10.8.2 The still chimney shall be fixed at the highest point of the still chamber.

4.10.8.3 An automatic control system shall

— prevent overfilling the still (above 75 % of the capacity), e.g. by closing the inlet valve, and

— cut off the heating in case this solvent level limit is exceeded, e.g. due to filling by hand-operated valves.

Advice shall be given in the instruction handbook on how to proceed in case of still overfilling.

4.10.8.4 The access door shall be fitted with an interlocking device preventing feeding and operation of the still if it is open or incorrectly closed, see ISO 14119. The related part of the control system shall present at least a performance level of PL = c in accordance with ISO 13849-1:2006.

4.10.8.5 A sight glass shall be fitted to the still chamber and equipped with a light source permitting observation of the distillation phase and the state of the residues before opening of the access door. The sight glass shall allow checking of the contents level in the still. The maximum level shall be durably and clearly marked on the sight glass. The sight glass shall be such that in the event of breakage, the still chamber is not exposed to the air, or shall be sufficiently tough to resist breakage, e.g. safety glass or glass reinforced by a screen.

4.10.8.6 The design of the closing mechanism of the access door shall prevent the door from being opened at once widely. The mechanism shall in a first stage allow only a very limited opening, permitting the operator to verify that no significant quantity of liquid is pouring out. Any slight escape of liquid shall not interfere with the possibility of manually closing the door rapidly.

4.10.8.7 The access door shall permit the rapid evacuation of residues into a lidded container of material, size, shape and capacity suitable for transporting it to a storage zone so as to minimize solvent emission. This container shall be supplied with the dry-cleaning machine.

Alternatively, a connection can be provided to allow, if required, safe disposal of residue by piping directly away from the still without solvent emission.

NOTE National regulations may require specific technical features for the collecting container.

4.10.8.8 A label, placed on or next to the access door, shall state that cleaning shall always be carried out with the dry-cleaning machine not in operation and with the still at room temperature. The label shall be reproduced in the instruction handbook.

4.10.9 Solvent emission when filling or topping up tanks

The solvent tanks shall be interconnected to permit overflow from one into another. The interconnection shall be placed at the highest possible level of the tanks.

The solvent tanks shall be fitted with level indicators showing the actual contents level, and the maximum permissible level shall be clearly and durably marked; these level indicators shall be visible to the operator when filling.

It shall be possible to carry out the filling operation by means of the solvent pump of the dry-cleaning machine via suction and gas displacement channels, closed by means of manual valves that return to the closed position when released.

4.10.10 Solvent emission resulting from faulty operation

A mode selector shall be fitted in accordance with ISO 12100-2:2003, 4.11.10. The choice of one operating mode shall exclude the use of any other.

The dry-cleaning machine shall be supplied with predefined automatic programmes for the basic uses. The dry-cleaning machine shall be capable of being operated manually, e.g. to execute an additional drying stage.

Interlocks within the control system shall be provided to prevent the dry-cleaning machine proceeding to an unsafe condition as the result of incorrect programming.

It shall be possible to determine, by observation of the control panel, the stage reached in the working cycle, e.g. by position of the card in a card controller, by the lights illuminated on a mnemonic panel or by an appropriate display on a computer panel.

Inspection devices shall be able to be opened only by means of a tool.

Parts of the dry-cleaning machine liable to release liquid solvent and having an inspection device shall have means of displaying the level of solvent.

4.10.11 Solvent emission resulting from cooling failure in the drying system

The coolant flow shall be interlocked with the heating of the drying system in such a way as to stop the drying and/or deodorization/reduction phase when the coolant flow is reduced below the rate required by the manufacturer for these operations, e.g. by a pressure sensor for the water service.

The dry-cleaning machine shall automatically stop in a safe condition and a visual and/or acoustical warning signal shall be given. For restarting the dry-cleaning machine, see 4.8.

4.10.12 Major spillage of solvent from the dry-cleaning machine

In order to restrict the free flow of solvent in the event of an accident, the dry-cleaning machine shall be placed on a spillage tray that is impermeable to solvent and strong enough to withstand the forces transmitted by the dry-cleaning machine.

The spillage tray capacity shall be either half the total capacity of the tanks, or the capacity of the largest tank, whichever is the greater, and shall be high enough to leave a freeboard of at least 30 mm.

NOTE National regulations may require specific technical details concerning spillage.

4.10.13 Thermal breakdown of solvent into toxic products

Provisions shall be made to prevent a heating system on the dry-cleaning machine (e.g. for heating of still) from raising the solvent temperature to a level at which the solvent will break down into toxic products.

4.11 Hazards related to loss of stability

Except if the dry-cleaning machine is sufficiently stable by design, provisions shall be made for anchoring the machine, while appropriate instructions shall be included in the information for use (see ISO 12100-2:2003, 4.6).

4.12 Hazards related to falling from a higher level

Where access to a higher level is required, the means of access shall be selected and designed in accordance with ISO 14122-1, ISO 14122-2 and ISO 14122-3.

4.13 Hazards related to the refrigeration system

The construction of the refrigeration system shall comply with EN 378-1 and EN 378-2.

5 Verification of the safety requirements and/or protective measures

The safety requirements and/or protective measures, as well as requirements of Clause 6, shall be verified in accordance with Table 3.

Table 3 — Verification list

Subclause of this part of ISO 8230	Subject	Verification method
4.1.1	Moving drive components and guards	Design verification, inspection and testing, measurement
4.1.2	Rotating cage	Design verification, inspection and testing, measurement
4.1.3	Ejection of machine parts	Design verification
4.1.4	Loading doors	
4.1.4.1	Crushing, shearing or impact	Visual inspection
4.1.4.2	Automatic door operation	Design verification and measurement
4.2	Thermal hazards	
4.2.1	Hot surfaces	Visual inspection, measurement
4.2.2	Steam heating	Visual inspection
4.2.3	Thermal fluid at atmospheric pressure	Design verification
4.2.4	System using pressurized fluids	Visual inspection
4.2.5	Cold surfaces	Visual inspection, measurement
4.3	Noise	Measurement of noise emission values (see Annex A)
4.4	Vibration	Design verification and inspection
4.5	Ergonomics	Design verification
4.6	Emergency stop and lack of cooling	Design verification, functional testing
4.7	Supply disconnection	Design verification
4.8	Power supply, other supplies, control system	Design verification, inspection and testing
4.9	Electrical hazards	Design verification and visual inspection and testing, including verification in accordance with IEC 60204-1:2005, Clause 18
4.10	Solvents emission	
4.10.2	Opening of the loading door	Design verification and testing
4.10.3	Evaporation of solvent from load	Design verification, measuring and testing
4.10.4	Rotating joints, etc.	Design verification
4.10.5	Lint filter	Design verification and testing
4.10.6	Button trap	Design verification and testing
4.10.7	Solvent filter	Design verification and testing
4.10.8	Distilling installation	Design verification, measuring, testing and inspection
4.10.9	Filling or topping up tanks	Design verification, testing and inspection
4.10.10	Faulty operation	Design verification, testing and inspection
4.10.11	Cooling failure in the drying system	Design verification and testing
4.10.12	Spillage tray	Design verification, inspection and measurement
4.10.13	Thermal breakdown of solvent	Design verification and testing
4.11	Stability	Design verification
4.12	Falling from a higher level	Design verification, measurement and inspection
4.13	Refrigeration system	Design verification and inspection
6.2	Signal and warning devices	Visual inspection
6.3	Instruction handbook	Visual inspection
6.4	Marking	Visual inspection

6 Information for use

6.1 General

Each machine shall be provided with sufficient information to enable efficient and safe operation in accordance with ISO 12100-2:2003, Clause 6. The information for machine use will usually comprise three types:

— signal and warning devices (6.2);

— instruction handbook (6.3);

— marking (6.4).

6.2 Signals and warning devices

A general warning notice of durable construction shall be fixed to the dry-cleaning machine in a position where it can be clearly seen by the machine operator, detailing the solvent hazards and the procedures to be followed in the event of a spillage or inhalation of solvent vapour.

Other warning notices may be required on any vessel that could contain solvent and that could inadvertently be removed from the dry-cleaning machine and cause a hazard.

EXAMPLE The vessel used to collect contact water from the water separator can cause an effluent hazard if disposed of incorrectly.

The nominal load of the cage shall be marked with a label on the loading door to alert the operator to the risk of inadequate drying of load if the dry-cleaning machine is overloaded. The wording of this label shall be reproduced in the instruction handbook.

A label placed next to the access door of the lint filter shall state that the lint filter has to be cleaned in accordance with the manufacturer's instructions as stated in the instruction handbook. The wording of the label shall be reproduced in the instruction handbook.

The maximum level of the liquid shall be durably and clearly marked on the sight glass of the still chamber.

A label placed on, or next to, the access door of the still chamber shall state that cleaning must always be carried out with the dry-cleaning machine not in operation and with the still at room temperature. The label shall be reproduced in the instruction handbook.

The solvent tanks shall be fitted with level indicators showing the actual contents level and the maximum permissible level clearly and durably marked; these level indicators shall be visible to the operator whilst filling.

The design of the safety signs shall comply with the principles of EN 61310-1.

6.3 Instruction handbook

6.3.1 General

An instruction handbook shall be provided with each machine, as specified in ISO 12100-2:2003, 6.5. The handbook shall contain the following specific elements.

a) Noise emission values (for their determination, see Annex A):

— the A-weighted emission sound pressure level at the workstation, where this exceeds 70 dB; where this level does not exceed 70 dB, this fact must be indicated;

— the A-weighted sound power level of the dry-cleaning machinery where the A-weighted emission sound pressure level at the workstation exceeds 80 dB.

These values shall be either those actually determined for the dry-cleaning machine concerned or those established on the basis of determinations taken for technically comparable machinery that is representative of the dry-cleaning machinery to be produced.

b) Requirements regarding energy supplies:

1) water:

— minimum and maximum pressure;

— minimum and maximum temperature;

— maximum instantaneous flow rate of coolant required;

2) compressed air:

— minimum and maximum pressure;

— flow rate required;

3) electricity:

— voltage and frequency needed;

— maximum current taken;

— installed power;

— maximum power drawn during an operating cycle;

4) thermal fluid:

— recommended grade;

— characteristics;

— replacement volume;

— minimum and maximum temperature;

— minimum and maximum flow rate;

5) steam:

— minimum and maximum pressure;

— maximum temperature allowed;

— flow rate required.

c) The total weight of the machine (see 3.4.4 to 3.4.7).

d) Information on the refrigeration system and quantity and type of the used refrigerant.

e) Information as required by IEC 60204-1:2005, Clause 17.

f) A reproduction of the content of the dry-cleaning machine plate and warning notices so that if these are lost or damaged they can be replaced correctly.

g) Information explaining how the dry-cleaning machine is designed to operate, the hazards (especially from solvent), and the safety features which minimize the risk of these hazards.

h) Warnings that draw the attention of the user to national regulations that may be necessary to control the exposure of personnel and the public to solvent, e.g. relating to vapour emission, residue disposal or contact water treatment.

i) Details of the still safety release pressure and methods by which the user may inspect the safety device.

j) Instructions for safe achievement of the following [items marked with an asterisk (*) should be written as step-by-step procedures that can be used for training]:

   1) basic installation information as described in ISO 12100-2:2003, 6.5.1 b);

   2) operator training;

   3) operation and operator maintenance (*);

   4) handling of the solvent;

   5) action to be taken in an emergency (*);

   6) engineer training;

   7) engineering maintenance (*);

   8) safety monitoring (*).

k) Specifications of the spare parts to be used important for the health and safety of operators.

When drawing up procedures for safe maintenance at least the following elements shall be considered:

— disconnection of all supply sources;

— measures against reconnection;

— neutralization of residual energy;

— verification of the safe state.

The information explaining how the dry-cleaning machine is designed to operate, the hazards and the safety features should be written simply and without the use of jargon, and so as to be suitable for handing out after training to operatives and engineers.

6.3.2 Special points of information

Dry-cleaning machines involve some hazards that are very specific to this type of equipment and that need particular mention in the instruction handbook. These are listed in Table 4 (see also Clause 4).

Table 4 — Special points to be included in the instruction handbook

General	Information explaining that this machine may only be used for the solvent mentioned in the instruction handbook. Information about the intended use of the dry-cleaning machine.
Installation	Information about the shut-off steam valve. The maximum operating temperature of any thermal fluid used, with an explanation of the implications for the maximum temperature setting at the control thermostat and the safety reasons for this. Information about disconnection devices for the energy supplies. Information about the anchoring of the dry-cleaning machine.
Electric equipment	A complete electrical wiring diagram for the dry-cleaning machine's electrical and control system, sufficient to enable verification of the level of security of all safety-related control systems and circuits.

Table 4 (*continued*)

Emergency stop and restart	Instructions as to the appropriate commands necessary to enable the drying of the articles following an emergency stop so that the cage door may be opened and the work unloaded.
Machine marking and warning notices	Any necessary warnings about the risk of burns from hot surfaces that cannot be otherwise protected. Any necessary warnings about the risk of burns from cold surfaces that cannot be otherwise protected. Details of the dry-cleaning machine label which specifies the nominal loading of the cage. Details of the label advising of the safety requirements that the lint filter shall be cleaned in accordance with the manufacturer's instruction handbook. Instructions for cleaning the lint filter to minimize inhalation of solvent vapour, dust or textile fibres. Details of the button trap label requiring that the trap has to be cleaned in accordance with the manufacturer's instruction handbook. Details of the label next to the still door requiring that cleaning shall always carried out with the dry-cleaning machine not in operation and with the still at room temperature.
Standard operating procedures	Information for the operator to minimize exposure to noise. Practical guidance on procedures for machine operations and operator maintenance which will minimize exposure to solvent liquid and solvent vapour, e.g. keeping the cage door closed, recognizing the articles that are not properly dried. Instructions on safe operating of the still so as to achieve optimum distillation rates without producing dangerous chemicals and without causing boil-over or solvent spillages. Instructions for filling or topping up solvent tanks on the dry-cleaning machine to avoid overflow or the release of solvent-laden air. Details of the operating sequences that may be required by the user and step-by-step instructions for making automatic programs (e.g. by punched card or computer) to achieve these.
Non-standard operating procedures	Instructions as to the appropriate commands necessary to enable the drying of the articles following an unintentional stop, so that the cage door may be opened and the articles unloaded. Instructions as to the steps to be taken in the event of a fault which generates an automatic shutdown. Instructions on how to proceed in case of still overfilling.
Operator maintenance	Instructions for periodic cleaning of the venting pipe. Instructions as to how the button trap can be cleaned with minimum release of solvent vapour to the workroom and without skin contact with solvent. Information on how to recognize when the solvent filter needs cleaning and the procedure for doing this, with explanation of the safety implications of non-compliance. Recommendations as to the occasions when suitable gloves or respiratory protection device should be worn, together with recommended specifications, and suppliers for these.
Engineering maintenance	Practical guidance on maintenance procedures to minimize inhalation of refrigerant gas or solvent vapour by maintenance engineers and others. Recommendations for inspection intervals concerning rotating joints, seals and hoses. Recommendations regarding engineering maintenance procedures which require the engineer to wear suitable gloves or respiratory protection devices, together with recommended specifications, and suppliers.
Safety monitoring	Ways in which solvent exposure data (staff monitoring) can indicate machine malfunction. Instructions to check the drying efficiency in order to avoid any increase of solvent emission to the workroom coming from the cleaned load. Precise recommendations for solvent leak testing procedures and the frequency with which these shall be carried out.

6.3.3 Guidelines for solvent handling

The instruction handbook shall also contain a brief set of guidelines on the handling of the solvent, to be considered as a help for the user.

The manufacturer shall take account of the information included in the relevant material safety data sheet (MSDS).

6.4 Marking

The dry-cleaning machine shall bear at least the following markings, which shall be permanent and legible:

— the business name and full address of the manufacturer and, where applicable, his authorized representative;

— designation of the dry-cleaning machinery;

— mandatory marking [2)];

— year of construction, i.e. the year in which the manufacturing process is completed;

— designation of series or type, if any;

— serial or identification number, if any;

— rating information.

Additionally, the dry-cleaning machine shall be marked with the whole solvent capacity of the dry-cleaning machine.

For modular machines, each module (e.g. cleaning unit, still unit) shall be separately identified and have its own machine plate.

The dry-cleaning machine plates shall be permanently fixed to the dry-cleaning machines and its durability shall match the life of the dry-cleaning machine.

Graphical symbols shall be in accordance with ISO 5232.

2) For machines and their related products intended to be put on the market in the EEA, CE marking as defined in the applicable European directive(s) such as that on machinery.

Annex A
(normative)

Noise measurement

A.1 General

This annex specifies noise measurement for all machines within the scope of this part of ISO 8230.

A.2 Determination of the emission sound pressure level

A.2.1 Workstation

The typical workstation for operating a dry cleaning machine is situated in front of the loading door. The A-weighted emission sound pressure level, $L_{p\mathrm{A}}$, shall be determined at a horizontal distance of 1 m ($\pm$ 0,05 m) in front of the centre of the loading door at a height of 1,6 m ($\pm$ 0,05 m) above the floor. The microphone shall be aligned parallel to the drum axis, facing the dry-cleaning machine.

A.2.2 Basic standards

The A-weighted emission sound pressure level, $L_{p\mathrm{A}}$, shall be determined in accordance with an International Standard listed in Table A.1, preferably ISO 11204:1995, grade 2.

Table A.1 — Basic standards for determining $L_{p\mathrm{A}}$

ISO 11201:1995	Grade 2
ISO 11202:1995	Grade 3
ISO 11204:1995	Grade 2 or 3

A.2.3 Measuring procedure

The A-weighted emission sound pressure level, $L_{p\mathrm{A}}$, shall be determined based on the operating conditions specified in A.5 and related to the standardized working cycle given in Table A.3. The partial emission sound pressure levels, $L_{p\mathrm{A},1}$, up to $L_{p\mathrm{A},4}$, related to these working phases are determined separately. The emission sound pressure level related to the standardized working cycle is calculated from Equation (A.1):

$$L_{p\mathrm{A}} = 10\lg\left(3\cdot 10^{0{,}1\cdot L_{p\mathrm{A},1}} + 10^{0{,}1\cdot L_{p\mathrm{A},2}} + 5\cdot 10^{0{,}1\cdot L_{p\mathrm{A},3}} + 10^{0{,}1\cdot L_{p\mathrm{A},4}}\right) - 10\ \mathrm{dB} \qquad \text{(A.1)}$$

A.3 Determination of the sound power level

A.3.1 Basic standards

The A-weighted sound power level, L_{WA}, shall be determined according to an International Standard listed in Table A.2, preferably ISO 3744:1994, grade 2. In that case, a box shaped measuring surface and a measuring distance of 1 m shall be used.

Table A.2 — Basic standards for determining L_{WA}

ISO 3744:1994	Grade 2
ISO 3746:1995	Grade 3
ISO 3747:2000	Grade 2 or 3
ISO 9614-1:1993	Grade 3
ISO 9614-2:1996	Grade 2

A.3.2 Measuring procedure

The A-weighted sound power level, L_{WA}, shall be determined based on the operating conditions specified in A.5 and related to the standardized working cycle given in Table A.3. The partial sound power levels, $L_{WA,1}$ up to $L_{WA,4}$, related to these working phases are determined separately. The sound power level related to the standardized working cycle is calculated from Equation (A.2):

$$L_{WA} = 10\lg\left(3\cdot 10^{0,1\cdot L_{WA,1}} + 10^{0,1\cdot L_{WA,2}} + 5\cdot 10^{0,1\cdot L_{WA,3}} + 10^{0,1\cdot L_{WA,4}}\right) - 10\ \text{dB} \qquad \text{(A.2)}$$

A.4 Installation and mounting conditions

A.4.1 Installation and mounting conditions shall be the same for the determination of the emission sound pressure level and the sound power level.

A.4.2 The conditions applying during the measurements shall be the same as those indicated by the manufacturer in the operating instructions.

A.4.3 During measuring, the dry-cleaning machine being tested shall be placed on a reflective (acoustically hard) floor, e.g. sealed asphalt or concrete.

A.4.4 Care shall be taken to ensure that pipes, air ducts, etc., that are connected to the dry-cleaning machine being tested but are not part of it, do not affect the measurements.

A.5 Operating conditions

A.5.1 The operating conditions shall be the same for the determination of the emission sound pressure level and the sound power level.

A.5.2 The dry-cleaning machine being tested shall be run with the maximum dry load (3.4.4) and within the normal operating temperature range.

A.5.3 The dry-cleaning machine being tested shall be run at the maximum permissible drum speed during spinning and at the maximum permissible fan speed fan during the drying cycle.

The standardized working cycle is presented in Table A.3.

Table A.3 — Standardized working cycle

Working phase	Ref.	Share of time %	Level
Cleaning	3.3.2	30	L1
Spinning	3.3.2	10	L2
Drying	3.3.3	50	L3
Deodorization/reduction	3.3.4 3.3.5	10	L4
Complete working cycle	3.3.1	100	L

A.6 Measurement uncertainties

The uncertainties are determined according to ISO 4871:1996. If no detailed knowledge related to the specific machine exists, the upper limit values in Table A.4 can be used.

Table A.4 — Maximum measurement uncertainties

Measurement uncertainty	Accuracy grade 2 dB	Accuracy grade 3 dB
K_{pA}	2	5
K_{WA}	2	4

A.7 Measurement report details

The measurement report shall include the information required by the basic standards applied and that necessary to produce the results reported according to A.8.

A.8 Results report details

The data provided in the test report shall enable the manufacturer to produce a noise emission declaration and third parties to verify the declared values. The test report shall be included in the manufacturer's documentation. At least the following data shall be provided:

— a sketch including the main dimensions of the dry-cleaning machine;

— the kind of loading and the mass of the dry load during the measurements;

— the basic standards used;

— the A-weighted emission sound pressure level, L_{pA}, and measurement uncertainty, K_{pA};

— the A-weighted sound power level, L_{WA}, and measurement uncertainty, K_{WA};

— any deviations from the requirements of this annex or of the basic standards used, including the reasons for such deviations.

Use of the model data sheet presented as Table A.5 is recommended.

Table A.5 — Presentation of results

Results report for noise measurements taken on dry-cleaning machines according to ISO 8230-1:2008, Annex A				
Machinery data				
Name and address of manufacturer/supplier:				
Type of machinery/serial no.:				
Main dimensions:	See attached sketch.			
Installation and mounting conditions:	[e.g. operating/assembly instructions, edition, page/section]			
Kind of loading:				
Mass of the dry load, kg:				
Key data from the working cycle:		**Duration** min		**Speed** r/min
	Cleaning			
	Spinning		Drum	
	Drying phase		Fan	
	Deodorization/reduction		Fan	
A-weighted emission sound pressure level, L_{pA}, at the workstation				
Basic standard(s) applied:				
Position of microphone as described in A.2.1?	Yes ❒	No ❒		
Measured values at each working phase, dB:	**L1** Cleaning	**L2** Spinning	**L3** Drying phase	**L4** Reduction/ deodorization
A-weighted mean value from Equation (A.1), dB:				L_{pA}
A-weighted sound power level, L_{WA}				
Basic standard(s) applied:				
Measured value at each working phase, dB:	**L1** Cleaning	**L2** Spinning	**L3** Drying phase	**L4** Reduction/ deodorization
A-weighted mean value from Equation (A.2), dB:				L_{WA}
Deviations from Annex A				
Any deviations from ISO 8230-1:2008, Annex A?	Yes ❒	No ❒		
Any deviations from basic standards applied?	Yes ❒	No ❒		
If yes, describe deviations and give reasons.	Enclosure ❒			

A.9 Declaration and verification of noise emission values

A.9.1 Declaration

The declaration of the noise emission values shall be based on measurements taken either on the relevant machine or on machinery with similar noise characteristics. The data required are

— machinery data,

— installation, mounting and operation conditions,

— basic standards applied, and

— L_{pA}, L_{WA}, K_{pA} and K_{WA} as dual-number noise emission values according to ISO 4871:1996.

Table A.6 presents an example of a declaration of noise values.

NOTE Shaded data represents that which is to be entered.

Table A.6 — Example of declaration of noise values

Type of machine, details of operating conditions	
Type:	123 A
Year of manufacture:	2008
Mass of dry load:	10 kg
Spinning speed:	500 r/min
Speed of fan:	2 800 r/min
[etc.]	
Dual-number noise emission values in accordance with ISO 4871	
Measured A-weighted emission sound pressure level, L_{pA}, at the workstation (re 20 µPa), in decibels	80
Uncertainty K_{pA}, in decibels	2
Measured A-weighted sound power level, L_{WA} (re 1 pW), in decibels	85
Uncertainty K_{WA}, in decibels	2
Values determined according to ISO 8230-1:2008, Annex A, with reference to basic standards ISO 11204:1995 and ISO 3744:1994.	

A.9.2 Verification

The verification shall be performed in accordance with ISO 4871:1996, 6.2, under the same installation, mounting and operation conditions as those used during the original calculation of noise emission values.

Annex B
(informative)

List of significant hazards

This annex specifies the significant hazards, significant hazardous situations and significant hazardous events that have been identified as being significant to the types of machines covered by this part of ISO 8230 and which require specific action by the designer or manufacturer to eliminate or reduce the risk.

	Hazard	Hazardous situation/event	Subclause of this part of ISO 8230
B.1	**Mechanical hazards**		
B.1.1	Crushing hazard	— Loading doors	4.1.4
B.1.2	Shearing hazard	— Loading doors	4.1.4
		— Moving transmission parts	4.1.1
		— Rotating cage	4.1.2
B.1.3	Entanglement hazard	— Moving transmission parts	4.1.1
		— Rotating cage	4.1.2
B.1.4	Trapping hazard	— Moving transmission parts	4.1.1
		— Rotating cage	4.1.2
B.1.5	Impact hazard	— Loading doors	4.1.4
		— Ejection of machine parts	4.1.3
B.2	**Thermal hazards**		
	Burns, scalds and other injuries by possible contact of persons with objects or materials with an extreme high or low temperature, by flames or explosions and also by the radiation of heat sources	— Hot surfaces	4.2.1
		— Steam heating	4.2.2
		— Systems using thermal fluid at atmospheric pressure	4.2.3
		— Systems using pressurized fluids	4.2.4
		— Cold surfaces	4.2.5
B.3	**Hazards generated by noise**		
	Hearing loss (deafness), other physiological disorders (e.g. tinnitus, stress, loss of balance, loss of awareness) Accidents due to interference with speech communication and acoustic warning signals		4.3

	Hazard	Subclause of this part of ISO 8230
B.4	**Vibration hazards**	4.4
B.5	**Hazards generated by neglecting ergonomic principles in machinery design**	4.5
B.6	**Hazards related to emergency stop and lack of cooling**	4.6
B.7	**Hazards related to energy supply disconnection**	4.7
B.8	**Hazards related to failure of the power supply, services or control system**	4.8
B.9	**Electrical hazards**	4.9
B.10	**Hazards generated by solvents**	4.10
B.11	**Hazards related to loss of stability**	4.11
B.12	**Hazards related to falling from a higher level**	4.12
B.13	**Hazards related to the refrigeration system**	4.13

Bibliography

[1] ISO 447:1984, *Machine tools — Direction of operation of controls*

[2] ISO 1219-1:1991, *Fluid power systems and components — Graphic symbols and circuit diagrams — Part 1: Graphic symbols*

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

[4] ISO 3747:2000, *Acoustics — Determination of sound power levels of noise sources using sound pressure — Comparison method in situ*

[5] ISO 4413:1998, *Hydraulic fluid power — General rules relating to systems*

[6] ISO 4414:1998, *Pneumatic fluid power — General rules relating to systems*

[7] ISO 8229, *Operations and baths relating to dry-cleaning machines — Vocabulary*

[8] ISO 9614-1:1993, *Acoustics — Determination of sound power levels of noise sources using sound intensity — Part 1: Measurement at discrete points*

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

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

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

[12] ISO 11161:1994, *Industrial automation systems — Safety of integrated manufacturing systems — Basic requirements*

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

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

[15] ISO 13853:1998, *Safety of machinery — Safety distances to prevent danger zones being reached by the lower limbs*

[16] ISO 14118:2000, *Safety of machinery — Prevention of unexpected start-up*

[17] ISO 14121:1999, *Safety of machinery — Principles for risk assessment*

[18] IEC 60034-5:2000, *Rotating electrical machines — Part 5: Degrees of protection provided by the integral design of rotating electrical machines (IP code) — Classification*

[19] IEC 60068-1:1988, *Environmental testing — Part 1: General and guidance*

[20] IEC 60073:2002, *Basic and safety principles for man-machine interface, marking and identification — Coding principles for indicators and actuators*

[21] IEC 60309-1:1999, *Plugs, socket-outlets and couplers for industrial purposes — Part 1: General requirements*

[22] IEC 60364-5-54:2002, *Electrical installations of buildings — Part 5-54: Selection and erection of electrical equipment — Earthing arrangements, protective conductors and protective bonding conductors*

[23] IEC 60445:1999, *Basic and safety principles for man-machine interface, marking and identification — Identification of equipment terminals and of terminations of certain designated conductors, including general rules for an alphanumeric system*

[24] IEC 60947-1:1999, *Low-voltage switchgear and controlgear — Part 1: General rules*

[25] IEC 60947-2:2003, *Low-voltage switchgear and controlgear — Part 2: Circuit-breakers*

[26] IEC 61000-1-1:1992, *Electromagnetic compatibility (EMC) — Part 1: General — Section 1: Application and interpretation of fundamental definitions and terms*

[27] IEC 61558-1:1997, *Safety of power transformers, power supplies, reactors and similar products — Part 1: General requirements and tests*

[28] EN 88:1991, *Pressure governors for gas appliances for inlet pressures up to 200 mbar*

[29] EN 125:1996, *Flame supervision devices for gas burning appliances — Thermo-electric flame supervision devices*

[30] EN 161:2001, *Automatic shut-off valves for gas burners and gas appliances*

[31] EN 230:1990, *Monobloc oil burners — Safety, control and regulation devices and safety times*

[32] EN 264:1991, *Safety shut-off devices for combustion plants using liquid fuels — Safety requirements and testing*

[33] EN 286-1:1998, *Simple unfired pressure vessels designed to contain air or nitrogen — Part 1: Pressure vessels for general purposes*

[34] EN 298:2003, *Automatic gas burner control systems for gas burners and gas burning appliances with or without fans*

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

[36] EN 407:1994, *Protective gloves against thermal risks (heat and/or fire)*

[37] EN 457:1992, *Safety of machinery — Auditory danger signals — General requirements, design and testing* (ISO 7731:1986, modified)

[38] EN 563:1994/A1/AC:2000, *Safety of machinery — Temperatures of touchable surfaces — Ergonomics data to establish temperature limit values for hot surfaces*

[39] EN 574, *Safety of machinery — Two-hand control devices — Functional aspects — Principles for design*

[40] EN 626-1:1994, *Safety of machinery — Reduction of risks to health from hazardous substances emitted by machinery — Part 1: Principles and specifications for machinery manufacturers*

[41] EN 626-2:1996, *Safety of machinery — Reduction of risks to health from hazardous substances emitted by machinery — Part 2: Methodology leading to verification procedures*

[42] EN 842:1996, *Safety of machinery — Visual danger signals — General requirements, design and testing*

[43] EN 894-1:1997, *Safety of machinery — Ergonomics requirements for the design of displays and control actuators — Part 1: General principles for human interactions with displays and control actuators*

[44] EN 894-2:1997, *Safety of machinery — Ergonomics requirements for the design of displays and control actuators — Part 2: Displays*

[45] EN 894-3:2000, *Safety of machinery — Ergonomics requirements for the design of displays and control actuators — Part 3: Control actuators*

[46] EN 982, *Safety of machinery — Safety requirements for fluid power systems and their components — Hydraulics*

[47] EN 55011:1998, *Industrial, scientific and medical (ISM) radio-frequency equipment — Electromagnetic disturbance characteristics — Limits and methods of measurement* (CISPR 11:1997, modified)

[48] EN 60447, *Man-machine interface (MMI) — Actuating principles* (IEC 447)

[49] EN 61000-6-3:2001, *Electromagnetic compatibility (EMC) — Part 6-3: Generic standards — Emission standard for residential, commercial and light-industrial environments* (IEC 61000-6-3:1996, modified).

[50] EN 61000-6-4:2001, *Electromagnetic compatibility (EMC) — Part 6-4: Generic standards — Emission standard for industrial environments* (IEC 61000-6-4:1997, modified)

[51] IEC 61310-2:2007, *Safety of machinery — Indication, marking and actuation — Part 2: Requirements for marking*

[52] IEC 61310-3:12007, *Safety of machinery — Indication, marking and actuation — Part 3: Requirements for the location and operation of actuators*

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