
**Safety requirements for dry-cleaning
machines —**

**Part 3:
Machines using combustible solvents**

Exigences de sécurité pour les machines de nettoyage à sec —

Partie 3: Machines utilisant des solvants combustibles

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Foreword

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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 8230-3 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 8230-3, together with ISO 8230-1:2008 and ISO 8230-2:2008, 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.

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Safety requirements for dry-cleaning machines —

Part 3: Machines using combustible solvents

1 Scope

This part of ISO 8230 specifies safety requirements for dry-cleaning machines that use a combustible solvent (CS), as defined in ISO 8230-1, as their cleaning medium.

It is applicable to such dry-cleaning machines, within the scope of ISO 8230-1, when they are used as intended and under conditions of misuse that are reasonably foreseeable by the manufacturer.

This part of ISO 8230, in conjunction with ISO 8230-1, deals with all 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.

It deals with the following significant hazards specific to the use of CS:

- hazards related to the entire dry-cleaning machine (electrical hazards, explosion hazards);
- hazards relating to the machine (combustible solvent emission, explosion hazards during the cleaning phase, explosion hazards during the drying phase);
- hazards relating to the distilling equipment (combustible solvent emission, explosion hazards).

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.

ISO 2719:2002, *Determination of flash point — Pensky-Martens closed cup method*

ISO 8230-1:2008, *Safety requirements for dry-cleaning machines — Part 1: Common safety requirements*

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

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

EN 13463-1:2001, *Non-electrical equipment for potentially explosive atmospheres — Part 1: Basic method and requirements*

EN 50104:2002, *Electrical apparatus for the detection and measurement of oxygen — Performance requirements and test methods* (amended by EN 50104:2002/A1:2004)

EN 60079-0:2006, *Electrical apparatus for potentially explosive atmospheres — General requirements*

EN 61779-1:2000, *Electrical apparatus for the detection and measurement of flammable gases — Part 1: General requirements and test methods* ¹⁾

EN 61779-4:2000, *Electrical apparatus for the detection and measurement of flammable gases — Part 4: Performance requirements for group II apparatus indicating a volume fraction up to 100 % lower explosive limit* ²⁾

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 12100-1 and ISO 8230-1 and the following apply.

3.1

area of explosion

area of concentration of a combustible substance in the air where an explosion can occur

3.2

lower explosion limit

LEL

lower limit of the area of explosion

3.3

lower explosion point

LEP

temperature of a combustible liquid at which the concentration of the saturated vapour equals the lower explosion limit

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NOTE If the lower explosion point is unknown, it can be assumed that the CS does not form any explosive vapour air mixtures if temperatures do not exceed 15 K below the flash point. During washing and spinning, the formation of mist is possible. With the operating conditions existing in the cage, the ignition energy required for droplet size and density is not reached by means of the ignition sources to be expected.

3.4

flash point

lowest temperature at which, under prescribed test conditions and in accordance with ISO 2719, a liquid releases combustible gas or combustible vapour in such quantities that a flame occurs immediately after contact with an effective ignition source

3.5

ignition temperature

lowest temperature of a hot surface, determined under prescribed test conditions, at which ignition of a combustible substance as gas air or vapour air mixture occurs

3.6

inert, verb

adding of inert substances to prevent the creation of an explosive gas atmosphere

1) IEC 61779-1:1998 modified.

2) IEC 61779-4:1998 modified.

3.7**inert gas**

gas that does not react with the vapour generated by the complete evaporation of the CS or oxygen

3.8**limiting oxygen concentration****LOC**

maximum oxygen concentration in a mixture of a combustible substance and air and an inert gas, in which an explosion will not occur, determined under specified test conditions

4 Safety requirements and/or protective measures**4.1 General**

Dry-cleaning machines using CS shall comply with the safety requirements and/or protective measures of ISO 8230-1, in as far as these are not modified or completed by the requirements of this clause and other requirements of this part of ISO 8230.

4.2 Hazards related to the entire dry-cleaning machine**4.2.1 Electrical hazards**

In addition to the requirements of ISO 8230-1:2008, 4.9, the electrical equipment of the dry-cleaning machine shall comply with the following:

- electric wires shall not be laid on floors or similar places where CS is liable to gather;
- all components made of conductive materials shall be connected to the protective bonding circuit.

4.2.2 Explosion protective measures**4.2.2.1 Display of malfunctions**

Malfunctions in the field of explosion protection measures shall be displayed visually and signalled acoustically.

4.2.2.2 Measuring systems**4.2.2.2.1 General**

NOTE It is assumed that with two independent systems whose failure is detected, leading to the cut-off of the machine, a failure of both systems at the same time is not to be expected.

The part of a control system of a dry-cleaning machine related to explosion protective measures shall be redundant or checked automatically so that failures cannot lead to an unsafe condition.

Control systems shall be safeguarded against involuntary maladjustment or manipulation, for example, by a fixed measuring sensor or limited possibility for adjustments. Manipulation shall be discernible.

Malfunctions shall be recognized automatically by the control before the dry-cleaning machine can go to an unsafe condition. At the same time, the machine shall stop automatically.

4.2.2.2.2 Concentration measuring instruments

Oxygen-measuring instruments shall be checked in accordance with EN 50104:2004, and CS measuring instruments shall be checked in accordance with EN 61779-1:2000 and EN 61779-4:2000.

The correct functioning of all concentration measuring systems shall be checked automatically during each working cycle. Faults shall entail the automatic stop of the dry-cleaning machine so that safe operating conditions are achieved.

NOTE 1 The air of the room can, for example, be used as test gas for oxygen measuring instruments.

Suction pipes for measuring gas shall be as short as possible.

The aperture where CS test gas is withdrawn shall be arranged in the area of maximum CS concentration during drying.

NOTE 2 As a rule, the highest CS concentration is between cage exit and drying condenser.

The suction pipes and measuring systems shall be arranged in such a manner that condensed CS cannot have an adverse effect on the results of the measurements.

EXAMPLE By heating the pipes.

4.3 Hazards related to the working cycle

4.3.1 Combustible solvent emission

4.3.1.1 Heating

The heating shall be interlocked such that the CS or air can be heated up to a temperature above the lower explosion point only when explosion protection measures are effective.

4.3.1.2 Sufficient drying

The drying temperatures and periods shall be selected and combined such that the CS is removed from the load. A sufficient degree of drying shall be controlled by a drying control system adjusted in accordance with the instruction handbook.

The occurrence of a technical failure that interrupts drying shall be clearly indicated visually or acoustically and shall cause the working cycle to stop.

It shall not be possible to withdraw the load from the dry-cleaning machine before drying is completed and the temperature in the outlet of the cage is below 50 °C.

4.3.1.3 Operation and maintenance of the water separator

Drainage for maintenance of the water separator and the associated tank shall be possible either via manual valves that close automatically when released or via a direct return circuit to the still or other reservoir.

The water outlet of the separator shall lead to a canister supplied with the dry-cleaning machine to avoid the loss of CS in case of failure. The capacity of the canister shall not be less than the maximum one day's production for which the machine is intended. The canister should be placed on the spillage safety tray.

It shall be possible to detect any presence of free CS in the contact water canister, e.g. by means of a sight glass.

A label on the tank shall indicate that the water contains CS (contact water). The wording of this label shall be reproduced in the instruction handbook.

NOTE National regulations may require specific contact water disposal.

4.3.2 Explosion protection measures during the cleaning phase

A temperature control device shall be provided that switches off the dry-cleaning machine and triggers a visual and acoustic alarm as soon as the CS temperature is more than 15 K below the flash point during the cleaning phase. Alternatively, one or the other of the following solutions can be applied:

- a) the machine parts containing CS with temperature higher than 15 K below the flash point shall be evacuated to low pressure as defined in 4.3.3.2;
- b) the whole interior of the machine shall be inerted in accordance with 4.3.3.5.

4.3.3 Explosion protection measures during the drying phase

4.3.3.1 General

One of the following explosion protection measures shall be taken.

4.3.3.2 Low pressure

4.3.3.2.1 General

This protection mode is based on keeping the pressure inside the dry-cleaning machine sufficiently low so that any pressure increase during an explosion will have no dangerous effect outside the machine, as far as the requirements of this clause are observed, with no additional safety measures being required.

For CS, the required low pressure shall be calculated on the basis of a pressure rise during an explosion of at least nine times the original pressure.

Solutions at a higher pressure level are acceptable when used in combination with additional measures such as control of temperature of condensation, air flow, etc.

4.3.3.2.2 Drum

The drum, including the loading door and its locking, the drying circuit and any valves isolating the drum from the dry-cleaning machine, shall be designed to withstand the pressure expected in the case of an explosion at low pressure prevailing in normal operation and where the explosion does not have dangerous effects outside the machine.

The drum shall be verified with 1,3 times the overpressure to be expected.

4.3.3.2.3 Vacuum pumps

Vacuum pump circuits shall be designed such that temperatures that are more than 15 K below the flash point cannot occur within them; alternatively, the temperatures in the circuits shall be monitored.

The evacuation pipes of vacuum pumps shall be designed such that evacuation of the exhaust gases to the open air is possible.

4.3.3.2.4 Pressure surveillance

The pressure level in the drum shall be continuously monitored. As soon as the operating pressure is exceeded, the heating shall be cut off automatically.

4.3.3.3 Limitation of CS concentration

The design of the dry-cleaning machine shall prevent the concentration of CS from reaching its lower explosion limit by means of one of the following.